CHEM. LIBRARY
MAR 15 1922
MAR 16 1922
CHEMICAL LIBRARY

GAS JOURNAL

LIGHT • HEAT • POWER • BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

VOL. CLVII. No. 3068.] LONDON, MARCH 1, 1922. [74TH YEAR. PRICE 1s.

OXIDE OF IRON
SPENT OXIDE

GAS PURIFICATION AND CHEMICAL CO., Ltd.
PALMERSTON HOUSE, LONDON, E.C.2.
Telegrams: "PURIFICATION, LONDON."
Telephone: 9144 LONDON WALL.

B. 290
Aluminium
Sheets, Circles, Tube,
Wire, Strand,
Rod, Bar,
&c.
BRITISH ALUMINIUM CO., LTD.,
109, Queen Victoria St., London.

R. & W. HAWTHORN LESLIE & CO., LTD.
In Stock.
TANK LOCOMOTIVES
Always in Progress.
Locomotive & Marine Engineers & Shipbuilders,
NEWCASTLE-ON-TYNE.

"TORBAY PAINT"
FOR ALL PURPOSES.
The TORBAY PAINT CO.,
26/28, Billiter St., LONDON, E.C.
39/41, Old Hall St., LIVERPOOL.

BUY YOUR
COKE SACKS
Direct from the
WEAVER & MANUFACTURER
HERBERT POCOCK
PARK MILLS,
SALISBURY.
ESTAB. 1778.

INTERMITTENT VERTICALS.
Adopted all over the World.
Vertical Gas Retort Syndicate LTD.,
17, VICTORIA ST., WESTMINSTER, S.W.
Sole Agents for Australasia
JAMES HURLL & CO., LTD., SYDNEY.

W. PARKINSON & CO.
(Incorporated in Parkinson and W. & B. Cowan, Ltd.),
LONDON & BIRMINGHAM.
(See Advertisement p. 490).

JAMES McKELVIE & CO.
Coal Owners,
Gas and Steam Coal Contractors,
17, RUTLAND SQUARE, EDINBURGH.
59, MARK LANE, LONDON, E.C.
GUILDHALL CHAMBERS, SANDHILL,
NEWCASTLE-ON-TYNE.
24, CHAPEL STREET, LIVERPOOL.
ESTABLISHED 1840.

STEWARTS AND LLOYDS, LIMITED, 41, OSWALD STREET, GLASGOW. BROAD STREET CHAMBERS, BIRMINGHAM.
TUBES & FITTINGS for Gas, Steam, Water, &c.

GEORGE GLOVER & CO., LTD.,
DRY GAS METER MANUFACTURERS.
Agents for the Patent "M & M" SELF-LOCKING SLOT-METER PADLOCK.

The STRENGTH and SECURITY of the "M & M" Lock depend not upon its EXTERNAL SHAPE, which has been imitated in various quarters, but upon the SPECIAL CONSTRUCTION of its INTERNAL MECHANISM.
The special mechanism, consisting of a sliding bolt fitted with TWO STUMPS and DOUBLE-ACTION LEVERS, is FULLY PATENTED.

See that each lock is stamped **M & M**, *and beware of inferior imitations.*

LONDON: *RANELAGH WORKS, ROYAL AVENUE, CHELSEA, S.W.3.*
TELEPHONE: 1140 Kensington.
WIRE: "Dry Meters, 'Phone, London."

LEEDS: *9, DEWSBURY ROAD.*
TELEPHONE: No. 26463
WIRE: "Meters, Leeds."

MANCHESTER:
GAYTHORN METER WORKS, EASTON STREET
PHONE: No. 6898 City. WIRE: "Slot, Manchester."

Reduce your Maintenance Costs by using "FERRODOR" ELASTIC PAINT It is the cheapest because it lasts twice as long as other Paints.
GRIFFITHS BROS. & CO. LONDON, LTD. BERMONDSEY, LONDON, S.E. 16.

MANCHESTER: GEORGE GLOVER & CO., LTD., 34, VICTORIA STREET, S.W. 1
KENTISH TOWN, N.W. & OTHER LONDON.

J. & J. BRADDOCK

(Branch of Meters Limited),

GLOBE METER WORKS,

Telegrams: "Braddock, Oldham." Telephone 815.

OLDHAM,

AND

45 & 47, WESTMINSTER BRIDGE ROAD,

Telegrams: "Metrique, Lamb London." Telephone 2412 Hop.

LONDON, S.E. 1.

MANUFACTURERS OF HIGH-CLASS

GAS STATION METERS.

BRADDOCK'S

STATION GOVERNORS

AND

RETORT-HOUSE GOVERNORS.

IMPROVED

WET & DRY GAS METERS

OF BEST QUALITY.

BRADDOCK'S PATENT

"SLOT" METERS.

FULL PARTICULARS ON APPLICATION.

RETORTS.

From one of the best known Gas Engineers in the country: "I find your Retorts more suited to the present-day conditions than any I have obtained elsewhere."

Write or 'Phone:

WILLIAMSON, CLIFF, Ltd.,

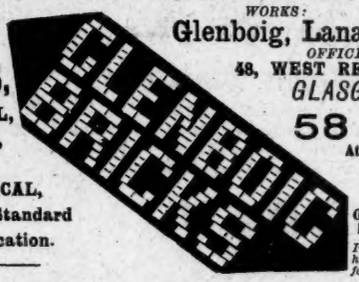
Gas Retort and Fire-Clay Works,

STAMFORD.

Telephones—16 Stamford. 1771 Avenue.

THE GLENBOIG UNION FIRE-CLAY Co. Ltd.

GAS-RETORTS, HORIZONTAL, INCLINED, and VERTICAL, to New Standard Specification.



WORKS: Glenboig, Lanarkshire.

OFFICES: 48, WEST REGENT ST., GLASGOW.

58 FIRST AWARDS At International and Home Exhibitions, including Grand Prize at Brussels, 1910.

In every case the highest award given for Fire Clay Goods.

The Glenboig Bricks, Blocks, and Retorts combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

B DONKIN D

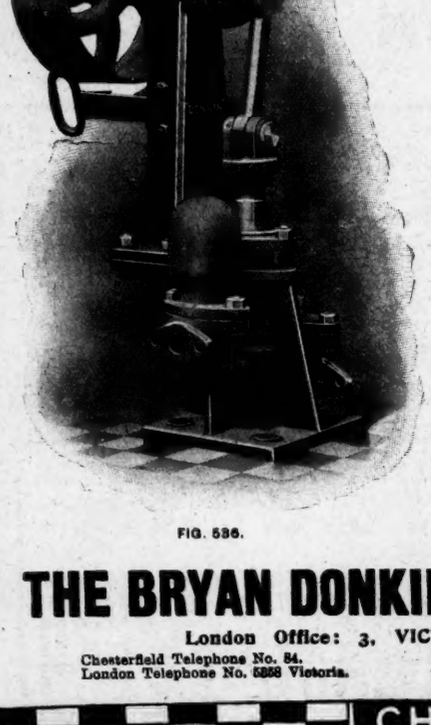


FIG. 536.

TAR, LIQUOR, & WATER PUMPS

MADE IN TEN SIZES.

Can be arranged for Working by Power or Hand.

BEST WORKMANSHIP. PROMPT DELIVERY.

Particulars sent on Application.

Makers of all types of Valves for Gas, Water, Liquor, and Chemicals, including Double-Faced Valves and Quick-Opening Valves.

GAS EXHAUSTING PLANTS OF ALL SIZES.

THE BRYAN DONKIN CO., LTD., CHESTERFIELD.

London Office: 3, VICTORIA STREET, WESTMINSTER, S.W. 1.

Chesterfield Telephone No. 84.
London Telephone No. 5858 Victoria.

Chesterfield Telegrams, "Donkin Chesterfield."
London Telegrams, "Donkin Vic. London."

B CHESTERFIELD D

GAS JOURNAL

LIGHT · HEAT · POWER · BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

PROPRIETORS: WALTER KING, LIMITED. OFFICE: 11, BOLT COURT, FLEET ST., LONDON, E.C. 4.

Telephone: Holborn 6857. —— Telegrams: "GASKING, FLEET, LONDON."

VOL. CLVII., No. 3068.] WEDNESDAY, MARCH 1, 1922. [74TH YEAR.

EDITORIAL NOTES.

Starving Research Work.

RESEARCH work cannot be carried on without money, and a sufficiency of it. No industry possesses such a field for research, and exhibits such possibilities of benefit from it, as does the gas industry; and yet the assessment and provision of the monetary requirements of research are of a miserable order. The matter was brought to notice in the report of the Executive Committee of the British Commercial Gas Association published in the "JOURNAL" on the 8th ult. What is stated there is a reproach to the industry, in view of the work that has been accomplished for it by research, and in view of the many, and ever-increasing number of, problems that require exploration and solution. At the meeting of the Executive Committee, it was pointed out that estimates of the Institution of Gas Engineers in respect of their Special Purposes Fund (out of which research work is financed) showed a deficit of £2000, after allowing for a special contribution of £1500 from the publicity fund of the National Gas Council. It was, after discussion, then and there decided that, out of the balance brought forward by the British Commercial Gas Association, a sum of £2000 should be contributed towards meeting the deficit of the Institution Special Purposes Fund. If there is this deficiency for research now, there will be, with the continuance of existing financing conditions, deficiency in the future; and it proves an inadequacy of provision for a vital part of the industry's co-operative work. This imposes serious limitations on the best work and efforts. Is this as things should be in an industry such as that in which we are concerned? To our mind, it is nothing short of a disgrace. The very character of the industry and its work shows how much it is dependent upon research for progress in stability and prosperity. Research at one time in the industry was absolutely neglected. The improvements that were made until quite recent years were entirely the outcome of empirical methods and venture. We know to-day how much research has the last few years come to our aid; and there are not a few among us who realize to the full that without research we should in future more than ever be groping about in the dark alleys of the unknown in the endeavour to make even slow progress. Every development of late years has made clearer the truth that research must be our guide.

Nevertheless, research is the most meanly financed of any branch of the work of the industry. Yet upon it now so much that is vital and material depends. There is here a melancholy lack of appreciation and proportion. Out of the 5s. per million cubic feet of gas output subscribed for the organized work of the gas industry, two-thirds, or 3s. 4d., is handed over to the British Commercial Gas Association, and one-third, or 1s. 8d., is retained by the National Gas Council, out of which latter sum 5d. is allocated to the Institution for research work. Only 5d. per million cubic feet for research work! The last issued Board of Trade returns show a make of gas by the statutory undertakings of the United Kingdom of 249,566 million cubic feet, 5d. on which would only amount to £5199 a year for research work for an industry of the magnitude of our own. But the pity is that all those millions are not subscribers on the 5s. joint subscription basis to the organized work of the industry; so there are not all the fivepences there might be to help to swell the exiguous co-operative financing of research. On the basis of the receipts for 1920-21 under the scheme of joint subscriptions, the 5d. would only amount to a little more than £3000 for the co-operative research work of the industry. That is not only inadequate; it is absolutely ridiculous. There is no other word for it. The responsibilities and services of research to the industry are enormous. The precedent responsibilities of the industry to research are of like character; but the expression of this fact is in the 5d. per million cubic feet on millions far short of the actual millions made. We should very much like to know the reason for this. Perhaps someone with the necessary ability for research will gratify our curiosity by investigating the matter, and letting us know the result. It is rather pitiful and a decided reproach to the industry that research should have to go cap in hand begging for adequate maintenance. The wherewithal for its maintenance ought to flow voluntarily and freely.

If the June Half Year Had Stood Alone!

THE value of annual accounts and annual meetings has been demonstrated very forcibly during the past year. What with the heavy slump in secondary products, and the load of expenditure and loss imposed by the coal-miners' strike, had the first half of the year stood alone, we are much afraid there would have been something like a panic among the more nervous section of gas stock and share holders. This condition, despite the low value of bye-products, the second half of the year with increased prices for gas did much to correct. The point as to the terrible effect of the combined circumstances upon results in the first half of the year, had it stood unsupported by the second half, was vividly illustrated by Mr. W. G. Bradshaw, in presiding at the meeting of the Commercial Gas Company last Thursday. "When "I tell you," he said to the proprietors, "that the balance of "profit for the first half of the year was only £4278, I "think you will consider that the final result may be "regarded as satisfactory." The "final result" was that the balance of profit carried to the net revenue account was more by £49,256 than for the previous year. Of course, the price of gas was raised, but there was a partial set-off in the loss of gas business equal to 8·39 p.ct., due to the general trade depression, the incidence of which is always acute in the East-end of London. The gas sales in that quarter of the Metropolis invariably serve as a remarkable index to the trade conditions there; and it would not have been surprising, in view of the parlous conditions of industry, trade, and employment, had the gas consumption decrease been of still larger dimensions. However, that miserable "profit" of £4279 for the first half of the year would have been, standing alone, a painful shock for the proprietors. As it was, on Dec. 31 there was a balance of £116,985 to transfer to net revenue, which was, of course, contributed to by the increase in the price of gas. The proprietors were satisfied to a degree which would have had its antithesis at June 30 had some of them known the facts of the position. Mr. Bradshaw also gave figures (set out in tabular form in the report of his speech) which show a striking contrast in respect of the net cost of coal in 1914, 1920, and 1921. They demonstrate in a very forcible manner the effect that secondary products receipts have upon the net cost of coal, and how disastrous were the two opposing forces of a slump in secondary products and a heavy expenditure on coal, much of which obtained from abroad was of a very inferior quality for gas and bye-product making. In the half year to June, 1914, the net cost of coal was 6s. 10d.; the secondary products then producing for the Company 10s. 10d. per ton of coal carbonized. Then we came to the extraordinary year 1920, when the secondary products produced the unprecedented figure of 36s. 10d. per ton of coal carbonized, and left the net cost of the coal at 6s. 5d., although the gross

cost of coal was 43s. 3d. Last year the gross cost of coal averaged over the whole year, through the circumstances already noticed, 5s. 3d. per ton more than in 1920, and the secondary products produced an average of 9s. 6d. per ton less, so that every ton of coal used during the year was at a net cost of 14s. 9d. more than in 1920—the net price per ton being 21s. 2d. Notwithstanding these hard facts, the section of the public newspapers that is so fond of girding at gas companies respecting the price of gas fails to see anything sound in the secondary products argument, and treats it with contempt. Before playing to the gallery, they should study such figures as Mr. Bradshaw presented last Thursday to the Commercial proprietors.

Price Policy.

THE past year brought two heavy burdens upon gas undertakings, each of which alone constituted something which, in the circumstances of the times, would have been sufficient to have crushed all hope of a speedy reduction in the price of gas, without counterbalancing help from other quarters of expenditure. Jointly, however, the secondary products slump and the coal strike imposed on the one hand a loss of revenue, and on the other an expenditure that would have caused many an undertaking to totter financially without there had been assistance in the way of an increased charge for gas. Although there has since been a substantial fall in the prices of materials and labour, those money-losing events have hindered many undertakings from giving effect to hoped-for gas price reductions. Therefore, censure in such a matter as current gas prices would be right or wrong according to the individual circumstances of an undertaking. Furthermore, where undertakings were particularly hard hit last year, suffering losses from the two causes already referred to, as well as from reductions in business due to bad industrial conditions, there has been in most cases a disposition to wipe out at once all losses, before making reductions and starting afresh, while another plan has been to spread the cost of the coal strike over a longer period. It is, of course, easy enough from the very secure rostrum of the Hornsey Gas Company for the Chairman (Mr. A. M. Paddon) to rebuke laggard undertakings in the matter of price lowering; but, looking at the points to which we have made allusion, there must be discrimination. Hornsey has a low capital account, and a good area for business, as exemplified by the increase in the sales of gas last half year. And the Company can boast the lowest price per therm today in the London area—11d. All this is highly creditable to the administration and to the Company's Engineer and General Manager (Mr. J. W. Buckley); but the position is not a general one.

With these qualifications, the exhortation of Mr. Paddon to gas undertakings to adopt a liberal price policy immediately is philosophically correct; and there is no doubt perfectly sound justification for his charge that certain gas undertakings (this is not by any means generally the case) are utilizing the unfortunate circumstances of the immediate past for reinforcing their financial conditions at the expense of present consumers, and to the detriment of prompt business expansion. Where this is being done, there is no question about the policy being wrong; and in the long run it will prove to be so. Mr. Paddon considers that this question of price transcends every other to-day. The high charges for gas that have been ruling were produced by artificial circumstances. Therefore, they should be regarded as temporary, and be resigned at the earliest possible moment. So regarding continued high prices, and subject to what has been said earlier in this comment, it is easy enough to adopt the argument of the censor of wrong price policy. He holds that this is not the time to reconstitute the finances of gas undertakings at the expense of the consumer. It is rather the time to re-establish the most favourable conditions for the consumer, and to give him the fullest possible value in what he is buying—if necessary at the expense of the undertaking. Some companies have adopted the stronger policy of re-establishing business with their consumers upon a low price basis, even at some little financial sacrifice for the time being. The reverse is quite a mistaken policy. Every effort should be made, even at some sacrifice, to convince the consumer of the economic value of the article the industry supplies. That is good and sound policy; but from the observations of Mr. Paddon, it is not the policy, even in some cases where it could obtain, that is being pursued by all gas undertakings. It is a matter that should receive immediate consideration from gas directors and committees. The competitors of the industry are lowering their prices, and sumultaneously intensifying their activities. Count has to be taken of what others are doing as well as of the question of securing financial rehabilitation as quickly as possible. While this is being done by the aid of continued high prices, business may be passing elsewhere, and the seeds that may produce the disunion of further custom may be sown. In business one has to be politic.

Seasonal Gas-Trading Developments.

WITH the diversity of gas applications, the seasons bring changes in the classes of trading enterprise in which gas undertakings have to engage. The natural light of the days is lengthening. This we are all glad to see; but it means a progressive reduction of the lighting load. Soon spring will be here, and warmer weather; and those increases in domestic consumption which have lately arisen from gas-fires through the cold weather in January and earlier this month will be business features which will have their record in the accounts for therms. From lighting and heating enterprise, gas sales departments will now be turning to cooking, hot-water supply, and the industrial uses of gas. Cooking is now well established; but it is a field not yet exhausted. Hot-water provision and the industrial uses of gas will now be actively taken in hand. These present extensive fields; but the price of gas has to come lower yet before the larger applications in these directions can have the maximum attractions of gas, in respect of labour and time saving and efficiency, placed upon them to accentuate the rate of development. To these matters, Mr. S. B. Chandler called attention in a paper he read on Friday before the members of the London and Southern District Junior Gas Association.

Regarding water heating, Mr. Chandler is of opinion that in geysers and hot-water circulating systems a considerable increase of business will accrue as time goes on. That is a pretty safe prediction. But in cultivating this business at the present time, discretion in recommendation is a valuable trait in an officer who has to advise consumers. The price of gas is a guide to recommendation; and there must be good judgment as to the capacity and willingness of the new patron to pay for the convenience. The geyser can be recommended always; a circulating system, which, of course, offers the greater range of convenience and the greater labour-saving, is something, with the price of gas where it is, that has to be recommended only in the light of investigated circumstances. Notwithstanding the price of gas, the fact that it is being brought down as rapidly as possible can be urged as a point in favour of at once adopting a circulating system in the highest class houses. Mr. Chandler also dealt with water heating in bulk, central heated systems, and steam-raising. A central heating system with gas as fuel may mean a higher cost than with solid fuel; but in numerous cases convenience, adaptability, regulation, and general service are counterbalancing factors. Where there is such central heating, too, there can be for room heating in the colder weather supplement by gas-fires. It is, however, highly important that no work of this kind should be advised, planned, or executed unless a good commercial-technical officer is in charge, and, further, unless a fair estimate of running costs is given. There must be no scope for after-complaint, as that is the worst possible thing that can happen in a business one desires to develop.

There is one thing we want to emphasize in connection with current and future papers on these subjects of gas use. An example must be made of Mr. Chandler in order to bring about a uniform reform. He deals with water supply in bulk, and uses as an example a considerable installation. He says that a test taken under working conditions gave an approximate efficiency of 76·8 p.ct., and a gas consumption of 2·5 c.ft. per gallon of water raised from 48° to 144° Fahr.—the temperature being taken at the taps a distance from the two storage tanks, after allowing for losses in heating, circulating, storage, and delivery. Instead of the consumption being expressed in cubic feet, why did not Mr. Chandler give it in B.Th.U., or at any rate supply the calorific value of the gas per cubic foot? It can be worked-out by the aid of the figures he furnishes; but why impose that trouble on those who read the paper, and have a desire to check the ascribed efficiency? The time has come for stating when quoting cubic feet the calorific quality of the gas, or speak-

ing directly in terms of B.Th.U. or parts of a therm. Anyway, we think it safer to say that the gas used in the instance already quoted is not the same gas as is referred to in an example of a centrally heated radiation system, in which example the gas consumption is given as 290 c.ft., or 1·6 therms. Why give the cubic feet and the therms in this instance, and not in the other? There must now be consistency in our technical work; and we must know every time what is meant in heat units when reference is made to cubic feet. If 290 c.ft. equal 1·6 therms, then 1 c.ft. equals 552 B.Th.U. That is not South Suburban gas; but it may be South Metropolitan.

In dealing with the industrial uses of gas, Mr. Chandler lays special emphasis upon the importance of a careful study of conditions before recommending or designing the necessary gas-consuming apparatus for the work. Unless this is done, there may be considerable waste, and thus inefficiency, and an irreparable injury to reputation. The advertising effect of waste and inefficiency is as great as that of economy and efficiency—only of a reverse order. Results are wanted that will stimulate, not stem, development of this business. There, again, the official of the company attending to this work should be specially qualified, because there are no standard appliances made that are suitable to all classes and quantities of work. Reference is made in the paper to steam-raising by gas. Generally speaking, for large operations, steam-raising by town gas is expensive; but there are special cases where it will pay. There is laundry work. We have heard of instances where gas is the fuel used for steam-raising; and the owners are pleased and well satisfied. Mr. Chandler alludes to the recent appearance of a steam-boiler employing low-pressure gas in a novel manner, and which has led to the installation of a number of units which are, to his personal knowledge, giving a good account of themselves, and are performing satisfactory service.

Though the winter passes and the summer approaches, there are always branches of the gas business appropriate to the season to which to turn attention—not forgetting all the time that the seasons succeed each other, and that every current season is the time when much work should be got through to serve the needs of the next.

Cavity Flues for Gas-Fires.

WE have been priding ourselves on the economy of small flues for gas-fires built in the outer walls of buildings, on account of the substantial saving they effect over coal-fire grates and chimneys, with their heavy chimney breasts. From the economy-promoting point of view, they are highly satisfactory. But there comes a note of warning from Mr. W. L. Westbrook; and it will be found in the short paper he read before the London and Southern District Junior Gas Association last Friday. It must not be supposed that, as a result of that warning, cavity flues are going to be abolished; the ways and means have to be found for realizing their economy, while not reducing the ventilating efficiency of the gas-fire. There is sufficient in what Mr. Westbrook says to cause the industry to go slowly with, but not to abandon the idea of, special flues for gas-fires. Our manufacturers of gas-fires have gone to a great deal of trouble to make them hygienic; and so, in any change of conditions in respect of their use, and the carrying-off of the waste products, nothing must be done which will violate the hygienic efficiency that has been secured. But this is actually being done in some instances. Experience is proving this; and it is also showing that cavity flues must be designed of a length sufficient and with suitable outlets so that, in any circumstances, there will be no chance of down draughts when a fire is alight, which would result in waste products being transmitted in the wrong direction.

In the area of the North Middlesex Gas Company, several builders have been constructing cavity flues in the exterior walls of houses—carrying them up 6 ft. or so, with ventilating-brick terminals. Excellent fresh-air inlets when the gas-fires are not burning, they do not allow the gas-fires to reverse with ease the air current on a typical November day—the result being that a proportion of products of combustion is sent into the room. So hygienic efficiency is reduced. One can also readily understand that the waste gases flowing in flues so built in outer walls will be subjected to a cooling effect; also that the wind blowing on the grating terminals of the flues will produce a good deal of downward pressure. These are physical effects which have to be taken into account. Obviously they had not received sufficient consideration in the design of the dwarf flues to which Mr. Westbrook refers. We have had experience of geyser ventilating-pipes, the functions of which have been sadly-impaired through outlets inadequate to purpose, and wind pressure that caused the products of combustion to flow in an improper direction, and that interfered seriously with flames and efficiency. All this is largely a question of technical skill in determining requirement in locating and fitting such appliances. In the case of the cavity flues, there are, of course, remedies for the imperfections. Mr. Westbrook quotes an experience which suggests one. In this instance, special gas-flues have been constructed of the cavity type, but extended so as to terminate in the roof space; and the result has been satisfactory. But here again, the roof space must be of adequate area; and the roof must not be sealed. If it is sealed, it should have a ventilating-pipe fitted through it, with a revolving extractor head.

The paper is useful in showing that the means of ventilation for gas-fires cannot be provided in any haphazard way. What is equally obvious is that there is no need for returning to the large area of the chimney, and the expensive chimney breasts. Just as these are in excess of need with gas-fires, so dwarf flues in outer walls with ventilating brick or grating outlet may be deficient of the essentials necessary to the proper performance of gas-fire duty under all conditions. Another interesting part of the paper is where Mr. Westbrook shows how internal ventilating-pipes for gas-fires can be made to increase efficiency in the general heating arrangements, in suitable places, by contributing a proportion of convected heat from the hot waste gases.

Therm Education of the Outdoor Staff.

There was a spirited discussion [published this week] on the paper by Mr. S. T. S. Musgrove on "Selling Gas by Therms," which was read at the recent meeting of the Yorkshire Junior Gas Association. Comment was made upon the paper in last week's issue; and in our remarks, as well as in "The Gas Salesman" supplement, emphasis was laid upon the importance of thoroughly educating in the therm change all members of the staff who come in contact with the consumers. In his reply to the discussion, Mr. Musgrove explained the educational method that is adopted at Sheffield. A short lecture is given to the fitters and the showroom and distribution staff during the first half hour in the morning. Fifteen to twenty minutes are spent in explaining what a B.Th.U. is and what a therm is, as well as the relationship with cubic feet. Then there is discussion, which is the most interesting part of the educational plan. Mr. Musgrove believes the fitters and other members of the staff are genuinely anxious to learn all about the change; and the best way to get them properly informed is to let them ask questions and talk about the subject The same system is carried out with all new appliances.

Labour Analysis.

A useful paper relating to an experience in promoting economy is that which Mr. A. Broadbent read at the meeting of the London and Southern District Junior Gas Association last Friday. The experience has been obtained in the fitters' section of distribution work of the Gas Light and Coke Company. Now in such a large concern as this, as will be readily seen, it would be very easy, without proper organization and supervision, to have a considerable amount of waste in the form of labour. Now that labour costs so much more than formerly, the more expensive has its waste become. With the view of cutting-out this waste as far as possible, a system of labour analysis was instituted, which Mr Broadbent interprets as meaning "the analysis of the day's work as recognized by labour." This analysis was designed to enable those in charge of the work to establish whether the best results were being secured with a minimum waste of labour, time, personal energy, material, and money. A "Fitters' Summary Card" had the times of the men divisioned into: "Working," "Walking," "Yard," and "Refreshment." A study of the data thus collected has enabled reorganizations and other changes to be effected. These have resulted in economies, which are expressed in a percentage reduction of walking and yard time and a percentage increase of working time. The details will be found in the paper.

Trade Unions and Managerial Functions.

Should trade unions have the power of interference in the exercise by employers of their managerial functions? At one time we should have looked upon a man who asked such a

question as not being in his right mind; and to-day we regard as a piece of impertinence the claim of trade union representatives to the right of interference. Nevertheless, as matters stand at the moment, the question threatens a serious contest in the engineering industry, though the trade unions know full well that right is on the side of the employers, and that the latter will, if there is a struggle over the issue, be the certain victors. The question has resulted in the Engineering Employers' Federation giving notice of a lock-out to all the members of the Amalgamated Engineering Union, to have effect on the 11th inst. This step has been taken in view of a ballot (only a small proportion of the members of the Union actually voted) which rejected a memorandum, acceptance of which was advised by the Executive Council of the Union, and which provided that the trade unions should not interfere with the rights of employers in respect of their managerial functions, nor the employers with the proper functions of the trade unions. The Amalgamated Engineering Union apparently do not like the look of things, and so they sought an interview with the employers. Although the latter consented to an interview, the notices were posted on Saturday; and this shows that the employers mean business, and will brook no nonsense. The issue, of course, is one which affects all industries. If the trade unions were successful in the engineering industry, there would soon be an attempt in other directions to abrogate the right of employers to manage their own works and affairs. Work could never be carried on properly, and discipline would soon be a thing of the past, if employers had to get the consent of the men or their representatives to this and that act of management, and always subject to the right of the latter to veto anything that was done.

Co-operation in the Coal-Fields.

The colliery owners evidently do not desire to embark upon any experiment of a compulsory committee system in the coal industry. Part II. of the Mining Industry Act, 1920, provides for this, and thus for giving opportunities for discussion between the owners and management and the workpeople. The owners may see the possibility of developments that would not assist in mutual good feeling and working, which is the pious intention of Part II. But experience shows that it all depends upon the men, their representatives, and their unions whether machinery for mutual discussion will run smoothly, and will be kept within legitimate bounds, and not be employed as an instrument for interference in managerial control. When the measure of 1920 was originally under discussion, the miners' representatives were vigorous opponents, and denounced the proposals from all points of view. The Government thus saw the futility of attempting to make Part II. operative except by agreement; and so they inserted a clause to annul this portion of the Act within a given period should the miners or owners fail to take steps to appoint representatives to the proposed committees and boards. One of the objections of the owners is that Part II. introduces a compulsory element into the committee system; and they prefer the voluntary pit committee system, which gives the workers every opportunity of meeting the accredited representatives of the colliery management on equal grounds for the discussion of such questions as working conditions and output. Now the Miners' Federation have changed their front; and they desire Part II. put into force. The colliery owners do not want it; and so the Government have decided to apply the annulling clause, which was originally inserted owing to the attitude of the miners' representatives. The Federation, inconstant as the wind, are now protesting against a position which they themselves did so much to create. Since then there has been the disastrous strike; and what they formerly rejected with contempt, they would be very glad to get to-day.

Gas Coal Position.

The same reports come from Northumberland and Durham as to the firmness of the gas coal market, owing to several of the collieries being well booked ahead—not only in respect of home business, but export. It is the export business that is "filling the bill;" and naturally prices, in these circumstances, continue to harden somewhat. These conditions are, of course, advantageous to other fields; and buyers abroad are looking elsewhere for supplies of gas coal. There is nothing striking in other coal areas. From most of them comes information of a steady demand, though lengthening and more open days have lessened the anxiety of home buyers to secure larger stocks.

PERSONAL.

It was cordially agreed at the recent annual meeting of the Ipswich Gas Light Company, in thanking Sir Daniel Ford Goddard for presiding: "That at this, the 100th annual meeting of the proprietors of the Ipswich Gas Light Company, it is unanimously resolved that the Right Hon. Sir Daniel Ford Goddard, P.C., J.P., be asked to arrange for his portrait to be painted in oils, which shall be presented to him as a slight acknowledgment of their appreciation of his life-long connection with the Company as Engineer, Director, and Chairman, which last position he has now held for twenty-one years with conspicuous success." The Vice-Chairman (Mr. Hugh Turner) referred to the unique fact of three generations of Goddards having served the Company. He said the Chairman's grandfather was one of the original shareholders, and in 1826 became Secretary and Engineer of the Company. He was succeeded by his son, the late Mr. Ebenezer Goddard, who was forty years Manager of the Company; and then came the present Chairman, who was first Assistant, and then Secretary, Engineer, and Manager. Sir Daniel Goddard has been connected with the Company for fifty years.

Mr. E. H. Swain, who has been acting as Engineering Assistant to the Gas Referees, has been appointed Gas Engineer to the Morecambe Corporation, in succession to Mr. R. H. Ruthven, who has gone to Ramsgate. Mr. Swain has had experience in a similar position at Pontypridd and at Bingley, and received special acknowledgment from Lord Moulton of his work during the war in connection with the extraction of toluole, &c., at the gas-works of fourteen Welsh towns.

Lieut.-Colonel A. H. Laybourne, a Director of the Newport Gas Company, figures in a list of new Justices of the Peace for Monmouthshire, issued last Wednesday.

Mr. H. Barton, A.S.A.A., at present Chief Accountant to the Aldershot Gas, Water, and District Lighting Company, has been appointed to the position of Accountant to the Aldershot Urban District Council.

Mr. Samuel B. Chandler, of the South Suburban Gas Company, has been elected an associate member of the Institution of Mechanical Engineers.

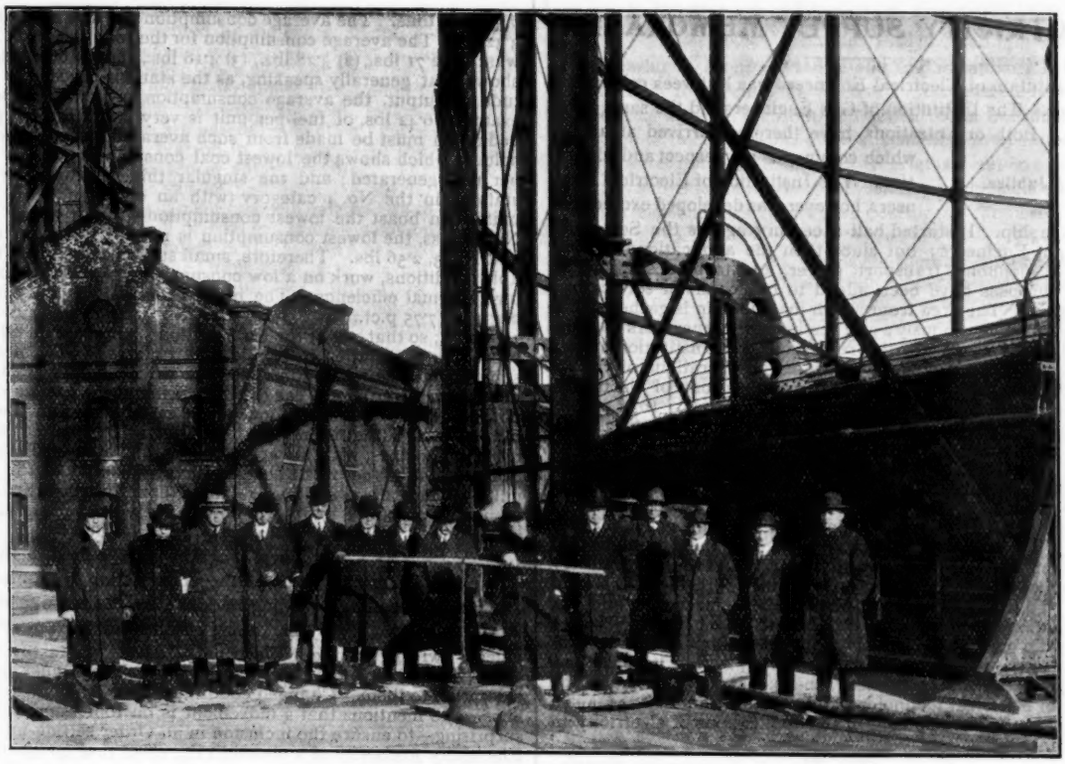
OBITUARY.

Mr. R. H. Butterworth, one of Scarborough's oldest residents, who died at the age of 83 on Thursday last, had been a Director of the Scarborough Gas Company for 38 years past. He was a native of Leeds, and a civil engineer.

We are sorry to have to record the death, on the 24th ult., following an operation, of Mr. Alexander Young, Managing-Director and Secretary to Messrs. R. Laidlaw and Son (Edinburgh), Ltd. Mr. Young had been associated with the firm for fully fifty years; and only six months ago he was made the recipient of a presentation on behalf of the staff, in token of their high esteem, on the occasion of his jubilee. A man of striking personality and culture, though of a retiring disposition, his kindly nature had endeared him to hosts of friends in, and connected with, the gas profession in England and Scotland. His unexpected death will have the effect of a personal bereavement to all who had the privilege of his acquaintance. He leaves a widow and five sons.

The Catalytic Theory of Mantle Incandescence.

Mr. S. Gulbrandsen, of the American Welsbach Company, has been writing to the "Gas Age-Record" on the subject of gas mantles and catalysis. He says in his letter that the catalytic theory of mantle luminescence had some support about twenty years ago, and was based on the assumption that the ceria, being a polyvalent element, became rapidly oxidized and deoxidized, and acted as a carrier of oxygen to the gas. In this way a very active local combustion at the mantle surface was supposed to be set-up, resulting in a high temperature. This theory was shaken when Killing, in 1906, placed a mantle over a hydrogen flame burning in an atmosphere of chlorine. These conditions precluded any oxidation, because no oxygen was present; and yet a brilliant light was obtained. The theory of selected radiation was advanced by Rubens in 1906, and elaborated by Dr. Ives in 1918. It explained so well all the known facts about mantle luminescence that it won universal acceptance. This theory may be stated in very simple terms: Pure thoria radiates heat energy to a smaller extent than any other body; and therefore, when placed in the flame, becomes hotter than anything else. However, being white at all temperatures, thoria cannot give light, no matter how hot it is made. It has been proved experimentally that the pure thoria mantle giving about 10 c.p. is hotter than a thoria-ceria mantle giving 90. By adding 1 p.ct. of ceria to the thoria, enough colour is imparted to the latter to enable it to emit light without materially reducing the temperature. If less than 1 p.ct. of ceria is added, the result is not so good, as the colouring power is not sufficient to produce the maximum candle power. If more than 1 p.ct. is used, the advantage due to the increased colouring power is more than offset by the drop in temperature caused by the higher heat-radiating properties of the ceria.



The Late Mr. William H. Bradley Turning Gas into the Astoria 15,000,000 c.ft. Holder.

THE ASTORIA FIFTEEN MILLION CUBIC FEET HOLDER.

Inauguration by the Late Mr. William H. Bradley.

The accompanying photograph was taken on Jan. 8, 1922, when gas for the first time was turned into the new 15 million cubic feet gasholder at the plant of the Astoria Light, Heat, and Power Company, Astoria, Long Island, N.Y. It was the last photograph made of the late Mr. William H. Bradley, Chief Engineer of the Consolidated Gas Company of New York and its affiliated Gas Companies. Mr. Bradley died ten days later, on Jan. 18. Mr. George B. Cortelyou, President of the Consolidated Gas Company, is at the left, with his hand clutching the bar of the key which was used to open the valve in the act of turning gas into the holder. Mr. Bradley is seen with his forearm resting on the bar. At Mr. Bradley's left stands Mr. Walter R. Addicks, a Vice-President of the Consolidated Gas Company of New York. Mr. George E. Woods, then Assistant Chief Engineer to "Chief" Bradley, and the successor of Mr. Bradley as Chief Engineer of the Consolidated Gas Company, is standing between Mr. Cortelyou and Mr. Bradley. The second man at the left, with the newspaper in his overcoat pocket, is Mr. H. W. Alrich, Assistant Engineer of Construction of the Consolidated Gas Company of New York.

THE CHESTER GAS BILL.

Basic Price and Dividends to be Adopted.

WHEN noticing early in the year the Bills that are being promoted in Parliament this session, we had not before us a copy of the late application of the Chester United Gas Company. The Bill is now to hand. It is to make new provision as to charges and application of profits. By the Gas Charges Order issued to the Company last year by the Board of Trade, there were substituted for the maximum prices authorized by the Company's Act of 1858 a maximum price of 16d. per therm for gas supplied within the city, and a maximum price of 17·2d. per therm for gas supplied elsewhere within the limits of supply. The Company submit that it is expedient there should be substituted for the present provisions regulating dividends payable on the ordinary capital provisions whereby such capital should receive by way of dividend a reasonable return at a fixed rate; and any surplus profits should, after providing for bonus to employee co-partners, be applied in the reduction of the price of gas with the object of seeing that the consumers and employees as well as the shareholders should have a direct and substantial interest in the reduction of the price of gas, and in the development and improvement of the undertaking. The clauses of the Bill provide that, as from the first quarter-day after the passing of the Act, the price of gas to ordinary consumers within the city and borough (the inner area) shall be 12·2d. per therm, which is to be called the basic price; and in any other parish and place within the limits of supply (the outer area) the price, it is proposed, shall not exceed that for the time being charged for a like supply in the inner area by more than 1·2d. per therm. It is provided that the basic dividend shall be 6 p.ct. per annum on the ordinary capital issued before the passage of the present measure, and at the rate of 8 p.ct. per annum on ordinary capital issued after the passing of the Bill. The clauses for the division of surplus profits provide that, if in any year the selling price shall have been below the basic price, then, if and so far as the amount standing to the credit of the net revenue account, after providing for dividend on the preference and ordinary capital at the basic rates, permits, an amount equal in the whole to one-half of the sum representing the difference between the amount the Company have received in that year and the amount they would have received in that year if gas had been sold by them in the inner area at the basic price and in the outer area at a price not exceeding the basic price by more than 1·2d. per therm, "shall be applied in such proportions as the Company shall resolve at the annual general meeting of the Company held next after the end of such year for the benefit of the holders of ordinary stock, and for the benefit of the employee co-partners, provided always that the amount to be so applied in respect of any such year for the benefit of the employee co-partners of the Company shall not be less than the amount so applied in respect of the same year for the benefit of the holders of such ordinary stock." The Company have borrowing powers equal to one-half part of the nominal amount of the preference and ordinary capital; and authority is now asked for powers to issue redeemable preference or debenture stock. Provision is also made for the removal of the limit of dividend on the authorized preference capital. Reserve and special fund clauses appear, as well as one providing for the holding of annual meetings. For the purpose of allowing the Company to elect any chief officer who has retired, or is about to retire, to be a Director, the authorized number of Directors may at any time be deemed to be increased by one, and the increase is only to continue so long as the official remains a Director. There are a number of ordinary provisions. There are profit-sharing clauses, as well as power to grant pensions. [*Parliamentary Agents: Messrs. Sherwood & Co.*]

The late Sir Arthur Lucas, who was a Director of the Imperial Continental Gas Association, and Deputy-Chairman of the Continental Union Gas Company, who died on Jan. 9, aged 76, left estate of the value of £65,125.

At a meeting of the Royal Sanitary Institute, to be held at 90, Buckingham Palace Road, S.W., on Tuesday, March 14, at 5.30, there is to be a discussion on "Central Heating in relation to Domestic and other Buildings," to be opened by Mr. A. H. Barker, B.A., B.Sc.

ELECTRICITY SUPPLY MEMORANDA.

THE Institution of Electrical Engineers was last week celebrating its jubilee. The Institution of Gas Engineers did the same thing in 1913. Both organizations have therefore arrived at an age which commands our respect and admiration. The Institution of Electrical Engineers, however, has developed exceedingly in membership. It started half a century ago as the Society of Telegraph Engineers; but since then the applications of electricity to telephony, transport, power, and to domestic and industrial purposes have been added to our common service and convenience. The area from which membership is gathered has thus expanded enormously; and the harvest of members has consequently been great. In this regard our own Institution stands in the background, and simply because the operations of the industry are not subdivided as are the applications of electricity. Thus the technical officials are not so numerous. In the electrical industry, the men of the gas industry have a large interest, and not only because of its trading competition, during the many years of which the gas industry has developed in parallel with it, but because the latter is linked up to it in many ways. The gas industry itself is not an inconsiderable user of electrical energy for special purposes; several undertakings are engaged in the production of not only gas, but electrical energy; there are signs that the number will be added to in the future; and the gas industry now supplies many electricity undertakings with fuel for steam-raising. To the Institution of Electrical Engineers, we add our congratulations to those many others that have been conveyed to it during the past week, and our good wishes for a successful continuation of the work which comes specially within its province. The organization has exercised a beneficial influence upon the progress of electrical technology and practice; and it has taken a great part in the development of the applications of electricity in all its branches.

A Jubilee.

Obstacles.

In "The Times" Engineering Supplement, there is an article on "The Electrical Outlook"—mainly in respect of the supply of electrical plant, the increased demand for which, of course, depends upon the augmentation of the demand for electricity. The article is in tone rather pessimistic, but perhaps not unduly so in view of the facts of the position. Apparently the writer does not see any prospect of an immediate boom in the call for electric plant. Some movement to increase plant capacity is noticed in the larger cities; but the orders so far placed are not of a very extensive order. The manufacturers, it is said, would like to see electricity suppliers embark upon a more active campaign to extend the domestic uses of electricity—not merely for lighting, but for cooking, heating, and domestic labour-saving appliances. In order, however, to encourage consumption for the last-mentioned purposes, a considerable reduction in the price of current, it is said, will have to be made. A "considerable" reduction! The writer did well to use an adjective that emphasizes the need for bringing the cost of electrical heating energy down to the prices of heating energy supplied by other agents. What is being, or can be, done to assist in producing a general considerable reduction? Nothing much immediately, other than that which the decline in market values permits. The elimination of wasteful stations and the supply of energy by the more efficient stations will help; but the writer in our contemporary fears that four or five years will have to elapse before this process is advanced far enough to bring about any appreciable reduction in the price of power. Moreover, it is doubtful whether, under existing conditions of trade and industry, there is a sufficient demand for more power to warrant the construction of large additional stations. The fact is that to attract new enterprises current would have to be sold at an exceedingly low rate. There are serious obstacles to that low rate. Therefore, things do not look over-promising. There are other writers who think the merits of electricity are more than sufficient to counterbalance the high price of current, and so are of opinion that the outlook is highly promising. They have been thinking that for a very long time; but the theoretical assumption is a long time realizing a material fulfilment.

Fuel and Efficiency.

The Electricity Commissioners have issued an analysis and summary of returns made by 421 generating stations belonging to authorized undertakers, and, in addition, returns voluntarily submitted in respect of 80 other generating stations owned by railway or tramway authorities or by non-statutory undertakings. The returns relate to generating data for the year ended March last; and these are highly interesting. The first table refers to 463 stations consuming coal or coke. The recognition of coke is interesting, because there is now a considerable quantity of it sold for steam-raising with beneficial efficiency results. Still more interest would have been found in the figures if the quantities of coke used had been distinguished from the coal. The concerns are classified into four groups: (1) Those with an output of over 50 million units a year; (2) those with an output of between 15 and 50 million units; (3) those with an output between 3 and 15 millions; and (4) those with an output under 3 millions. The total output of the 463 stations for the year was 4,955,514,403 units; and the quantity of coal and coke used was 7,356,757 tons. The average consumption per unit generated was 3·32 lbs. The average consumption for the four classes of station was: (1) 2·71 lbs., (2) 3·28 lbs., (3) 4·16 lbs., and (4) 6·42 lbs. This shows that generally speaking, as the stations descend in magnitude of output, the average consumption of fuel increases—for example, 6·42 lbs. of fuel per unit is very bad. But no positive deduction must be made from such averages, because there is a column which shows the lowest coal consumption at any station per unit generated; and the singular thing is that one of the stations in the No. 4 category (with an output under 3 million units) can boast the lowest consumption—with 1·7 lbs. In the No. 1 class, the lowest consumption is 1·78 lbs.; No. 2, 2·19 lbs.; and No. 3, 2·56 lbs. Therefore, small stations can, given favourable conditions, work on a low consumption of fuel and exhibit a high thermal efficiency. The highest thermal efficiency in No. 1 class is 17·75 p.ct., No. 2 14·28 p.ct., No. 3 13·91 p.ct., and No. 4 15·5 p.ct.; so that one of the No. 4 stations can boast an efficiency exceeding any station in Nos. 2 and 3 classes. The next table supplies data as to stations operated by oil-engines, waste heat, heat from destructors, gas-engines (using town gas), and water power. There are six stations using gas-engines and town gas; but the total output is only 4,180,566 units. There are 62 stations using oil-engines, with an aggregate output of 23,726,403 units. Some 15 stations use waste heat, and have an output of 161,569,982 units. There are 34 stations obtaining heat from destructors, and having an output of 17,613,330 units. There are 12 stations using water power, with an output of only 4,732,410 units.

Super-Stations and Changed Conditions.

There is a growing apathy over the question of the construction of capital generating stations; and there are good causes for waning enthusiasm. "A Station Engineer," writing in the "Electrical Times," points to some of these; and he says the Electricity Commissioners must give consideration to them. Changed conditions have made a vast difference. He mentions that a movement is on foot—and this is not surprising—to ensure the inclusion in an Order setting-up a Joint Electricity Authority of a clause to the effect that no undertaking shall be called upon to close down if it can be proved that it would be cheaper to generate individually in existing generating stations, or in extended generating stations, than by taking a supply in bulk from a central authority. It has in this connection to be remembered that the Act of 1919 allows for a surcharge upon all undertakings taking a supply of any loss sustained by the Central Authority. Therefore, it is quite possible to be supplied at a cheaper rate than any undertaking could generate at, and yet suffer a loss on account of this surcharge. "Station Engineer" says that at the last London inquiry it appeared to be generally accepted that a capital station should supersede existing generating stations in the course of time, and that the majority would be shut-down ultimately. Consideration does not appear to have been given to the fact that, although each undertaking is required to generate electricity during 8760 hours per normal year, yet the bulk of the supply is generated between the hours of 6 a.m. and 7 p.m. per ordinary working day, which amounts to 3679 hours per annum. Therefore, points out the writer, during the remaining 5081 hours, when the load is light, it will be found that, by combining the loads of a number of generating stations, an economical load can be thrown upon a capital station, and a limited supply be given to each station in the combination at a cheaper rate than the supply could be generated at in existing isolated stations. The writer goes on to assert that there is no pressing need for capital stations; but he thinks more attention should be given to the linking-up of systems under present-day conditions, for the purpose of meeting the requirements of a group of stations during the periods of light demand.

Some Further Considerations.

The interesting article towards the end shows how the position has changed. The writer points out that there has been no appreciable reduction in the rate at which money can be raised; and the capital cost of erecting super-stations, installing plant, and laying main transmission lines is probably not more than 15 p.ct. less than the cost taken into account at the date of the London inquiry; but the cost of coal, the saving of which was set against the cost of capital stations and transmission lines, has fallen materially. At the time referred to, 35s. per ton for coal of a value of 10,500 B.Th.U. per lb. was the basis of calculation; but "it is possible to-day to obtain coal of 11,500 B.Th.U. for 18s. 6d. per ton, with the prospect of a further fall of 3s. 6d. when railway rates and wagon-hire charges are adjusted." The use of the fork instead of the shovel at collieries has also made a difference in respect of the amount of ash for removal, the cost of which work has likewise diminished. These facts lessen the case for the capital station, the value of which was computed in the worst of financial circumstances.

Meteoric Displays.

"Meteor" of the "Electrical Times" has been treating his readers to more inflated language on the subject of gas poisonings. He says the gas interests are "alarmed" over the carbon monoxide question. The gas interests are not alarmed. To state facts in reply to would-be alarmists cannot be described as being alarmed. They ask, and that fairly, that the matter in question shall be examined in the light of those facts. That is only just; but "Meteor" is an exemplification of many other newspaper

writers on this topic. It simply does not suit his book to give the side of the case as presented by the gas suppliers; it suffices for him to poke fun. He cannot follow the Governor of the Gas Light and Coke Company when he makes out that the railways kill eleven times as many people per annum per million of the population as gas does. This "extraordinary item" makes him wonder "how the other figures are based"—the other figures being those quoted by Mr. Milne Watson in his address to the proprietors of the Company at the recent annual meeting. Then as to the "danger" of odourless gas, he notices that a Special Order has been introduced in Parliament compelling suppliers to impart the distinctive pungent smell of coal gas to their commodity. What of that? All gas distributed in this country has that distinctive pungent smell. What the Order does is to prevent pure water gas being distributed. There must be a proportion of coal gas mixed with the water gas to impart to it the distinctive pungent smell of coal gas. Apparently "Meteor" is astonished at Dr. Carpenter's statement that in the South London district there has not been a fatal accident due to gas poisoning for over twenty years. He need not be astonished. If he will read the editorial in "The Gas Salesman" issued with last week's "JOURNAL," he will find other statements that may also astonish him. There is a great deal, too, in the assertion of the President of the National Gas Council that gas is actually helping to lower the death-rate. "Meteor" obviously has such a narrow outlook that he cannot see this. To help to purify the atmosphere by providing gas at as cheap a rate as possible for fuel purposes, must have that salutary effect. It is one of the lessons of the reports on smoke abatement. We do not discern any evidence of "panic" among the public; this is part of the hyperbole of "Meteor." What we have seen is that, so far this year, the public have shown a wonderful desire to increase their use of gas; and they have done it throughout the whole of the cold weather. The public are not all fools. They know that gas properly used is a valuable servant. Among all the fatalities traceable to gas lately, there have been only two or three cases of actual accident. But "Meteor" has found a "shoal" of gas poisonings, explosions, and fatalities. Will he put a figure to the "shoal," and discriminate between suicides, gross negligence, and pure accidents? He also makes a point about the figure for unaccounted-for gas in the Gas Light Company's last accounts. He appears to think that this is gas that is practically all distributed in the air. Apparently he knows nothing about the effect on the item of unaccounted-for gas of the difference in temperature at which gas is measured at the works' station meters and at the consumers' meters, also of condensation; and he has forgotten that the sum includes the amount of gas unregistered by consumers' meters that are running slow. "Meteor" is on unsafe ground, though he tones it down with—

> Full many a therm is born to blush unseen,
> And waste its sweetness on the desert air.

Gasfilled Lamp Temperatures.

The "Electrician" calls attention to the fact that the temperatures of gasfilled lamps are such that care should be taken in their use. From an American investigation, it appears that with gasfilled lamps there is a much greater loss by heat convection than in the case of the vacuum type—20 p.ct., compared with 8 p.ct.; and bulb temperatures approaching 500° Fahr. are recorded. It is easy to see from this that care should be taken not to have inflammable materials in contact with such lamps. Contact may mean serious trouble.

Sheffield Gas Company's Report.

At the meeting on the 13th inst., the Directors will report that the total quantity of gas sold during the twelve months ended Dec. 31 was 4,405,555,000 c.ft., being a decrease of 654,388,000 c.ft., or 12·93 p.ct., on the previous year. This is undoubtedly due to the great depression of trade and industry in Sheffield, as the consumption of gas for domestic use shows a favourable increase. An interim dividend was paid on the half year ended June 30; and after paying the dividend for the six months ended Dec. 31, there will be a balance of £19,224 to be added to the amount previously carried forward. Under the Gas Regulation Act, 1920, the Company obtained an Order which came into operation on March 24; and as from that date the declared value of the Company's gas has been 480 B.Th.U., and the rate charged 10d. per therm. From the date of the Order, 5 p.ct. dividend was payable on all ordinary stock. During the year there was a coal strike of three months' duration; but the Directors are pleased to report that they were able to maintain an uninterrupted gas supply without having to purchase coal at enhanced prices, with the result that it was not necessary to increase the price of gas. From the December reading of the meters, the price of gas has been reduced to 9d. per therm, which makes the Company's charge one of the lowest in the country.

At a meeting of the Association of Engineers in-Charge, at St. Bride's Institute, next Wednesday, March 8, at 7.30, Mr. A. Hugh Seabrook is to read a paper on the "Thermal Efficiency of Small Power Stations and Methods of Comparison." Sir Charles Bright has promised to take the chair.

A POPULAR CHEMICAL DICTIONARY.*

IN preparing a second edition of this important work (which was reviewed in these columns when it first appeared, in 1919), the author has widened its scope and added to its usefulness by the inclusion of many subjects of great scientific or technical interest which were not mentioned in the original edition. It is now what its sub-title claims for it—a veritable cyclopædia of chemical science, especially as regards its bearing on the useful arts and manufactures.

Into a volume of some 500 pages there is compressed a great amount of reliable information on a bewildering variety of subjects. Information which would otherwise have to be sought for at great cost and trouble is here presented in brief summary, and in language that may be easily comprehended. For this reason the book is calculated to be of great service to the busy technician or professional man. Business men, whose commercial interests are bound up with the successful application of chemical science to industry, may conceivably acquire from its pages an intelligent interest in the scientific foundations of their business, which will add a new zest to their commercial transactions; while the practising chemist will find the book of commanding interest.

It is impossible to give more than a rough indication of the great variety of subjects covered by the book; but even this may serve to show what a wide net has been cast by the author. Under various headings will be found a concise summary of the laws and processes of chemical action, and the generally accepted theories which define and explain them. Light, heat, and other forces are dealt with in a similar fashion, though not so extensively. The operations of practical chemistry are described, in connection with both laboratory work and the manufacturing processes that are based upon applied chemistry. Then the major portion of the dictionary is taken up with notices of the multifarious substances in nature and art to which the prefix "chemical" more or less closely applies. The value of these notices is enhanced by the use of cross references, which enable a complicated or difficult subject to be followed up with success through its various ramifications.

In so far as we have been able to test it, the information that is given is thoroughly sound and reliable, and this to a quite remarkable extent considering the expert knowledge which is implied in the preparation of much of it. It is also quite up-to-date, as will be recognized when we add that subjects like catalysis, colloids, atomic structure, flotation processes, theories of lubrication, and many other matters that are of pressing interest to the scientist or technician of to-day are quite adequately expounded or discussed by the author.

We have not noticed any errors, except that under the heading "Fertilizers" ammonium sulphate is compared with ammonium nitrate, whereas we imagine that sodium nitrate is intended.

We heartily commend the book to the attention of our readers.

* The Popular Chemical Dictionary: A Compendious Encyclopædia. By C. T. Kingzett, F.I.C., F.C.S. *Second Edition.* London: Bailliere, Tindall, and Cox. Price, 21s. net.

AN ISLE OF WIGHT CELEBRATION.

The jubilee of the Newport (Isle of Wight) Gas Company (1870 1920) and the centenary (1821-1921) of the supply of gas to the Borough of Newport have been fittingly marked by the compilation and issue in booklet form of a history of the Company since its incorporation. The compiler—Mr. Frank King, who is the Secretary of the Company, and has been associated with it almost from its incorporation—is to be congratulated upon the interesting manner in which he has marshalled his facts. There are portraits of the three Directors named in the 1870 Act, and of Mr. Joseph Reed, the first Manager, and a list of all succeeding Directors, Engineers and Managers, and of the Secretaries. Mr. Frank King, it is noticed, was appointed Secretary in 1892; and Mr. F. E. Cox, Engineer and Manager—who contributes a foreword—in 1919. The present Directors are Mr. Robert Pinnock, J.P. (Chairman), Mr. A. W. Oke, B.A., LL.M. (Deputy-Chairman), Mr. C. Webb, Captain C. B. Pinnock, and Mr. S. W. Ibbotson.

As has been stated, the Company were incorporated in 1870; the works having been established on the present site for nineteen years prior to the formation of the Company, and carried on by the private enterprise of Sir Augustus Hilary and others. Prior to the year 1821, it is learned, gas works had been erected by Messrs. John and George Barlow, at Pan Bridge, Newport; and these works were subsequently taken over by a Company incorporated by an Act which received the Royal Assent on May 28, 1821. This Company, however, appears to have strongly resented the competition of Sir A. Hilary; and eventually the financial position, as judged by the quotation for the shares, was the reverse of flourishing. Having bought up a number of shares, and thus obtained a controlling interest, Sir A. Hilary and his co-partners acquired the Company's undertaking in 1857.

The price of gas was fixed by the 1870 Act at 5s. per 1000 c.ft., and the maximum dividend at 10 p.ct. The price named was charged until 1881. Upon formation, the Company were at once

successful; for in 1872 a dividend of 7 p.ct. was paid, for the following year 8 p.ct., and for many years subsequently 10 p.ct. Under an Act of 1901, the Company were placed upon the sliding-scale; the standard selling price of gas being fixed at 4s. per 1000 c.ft., and the standard dividend at 5 p.ct. At the same time, the shares were converted into stock. Until 1915 dividends of from 5¼ to 6 p.ct. were paid on the converted stock; and in 1914 the price of gas was down to 3s. 4d. per 1000 c.ft. Then, of course, came the period of high costs, with the inevitable increase in the price of gas to 6s. 6d. per 1000 c.ft., and a fall in dividend.

As an appendix are reproduced some instructive and amusing extracts from the minutes of the Newport Gas Light Company, 1821. These set-out the "price of gas-lights per annum of 313 days," and the regulations to be observed by consumers. Even in the good old days it seems "some individuals neglected to pay the rent of gas till repeatedly called for;" while "several individuals were in the practice of burning the gas beyond the time stipulated in their agreement." On a proposition in 1850 that the price of gas be reduced to 10s. per 1000 c.ft., it is recorded that "it was carried unanimously, except as to five shareholders, who voted against it." Elsewhere it was recommended "that the men be supplied with a gallon of beer a day till further notice," and "that when the syphons are pumped out the contents shall be received in buckets, and not left in the street."

In 1826 the following conditions of supply of gas were issued to consumers:

Price of Gas-Lights per Annum of 313 Days.

No.	Description of Burners.	From Dusk to 8 & 9.	From Dusk to 10.	By Meter at 15s.
6	Argand, 16 holes . . .	£4 0 0	£4 10 0	Per 1000 c.ft.
4	Ditto, 12 holes. . . .	£3 3 0	£3 10 0	
	Passage light	£2 0 0	£2 0 0	
2	8-hole window lights . .	£2 5 0	£2 10 0	
	Cockspurs or 3-jets light.	£1 16 0	£2 2 0	For open shops only
	Cockspurs or 3-jets light.	£1 10 0	£1 15 0	
	One jet burner. . . .	£1 0 0	£1 5 0	Auxiliaries

COOKERY AND FOOD EXHIBITION.

ONCE again last week, the Royal Horticultural Hall, Vincent Square, S.W., was the scene of the annual Cookery and Food Exhibition; and visitors saw displayed on every hand dishes which were only too well calculated to make many of those whose eyes rested upon them sadly discontented with the every-day cookery of which they had practical experience. These annual exhibitions—last week's was the twenty-sixth of the series—are promoted to awaken public interest in the art of cookery and place it in a position worthy of its increasingly vital importance to national health and progress. All must wish success to so laudable an object; and if attendance is anything to judge by, the well-filled condition of the hall would indicate that success in considerable measure has attended this year's exhibition.

Nowadays it is impossible to consider cooking in any aspect without bringing gas into the calculation; and that is why we always hope—and never in vain—to see gas adequately represented on these occasions. Invariably the Gas Light and Coke Company, in whose district the hall is situated, have a stand which proves a centre of attraction to housewives—and others who may have to cook. Last week they made a show which was in every respect up to the high standard which their previous exhibits had set them. It took the form of a spacious model kitchen, well lighted by pendants and brackets on the pneumatic switch system; and provided with a lot of apparatus connected-up and in full working order. In the centre was a Sugg "Ranelagh" cooker, which had a Larkin hot-plate at the side of the oven, with a shelf underneath for saucepans, &c. In handsome nickel and aluminium finish, this cooker found many admirers. The attention of readers may be called to the fact that an illustrated description of the Larkin hot-plate appeared in the "JOURNAL" for Dec. 15, 1920 (p. 636-7). It was there pointed out that the aim of the invention was to combine as far as possible the economy of the solid hot-plate for multiple boiling with an improved efficiency in connection with boiling in a single vessel. A chart reproduced at the same time, giving comparative gas consumptions, showed a very substantial saving in gas consumed, by the use of the Sugg-Larkin hot-plate. In addition to this cooker, the model kitchen contained a Potterton No. 51 hot-water set; a Parkinson "Gacylette" water-heater over the sink; a Keith gas iron (with which demonstrations were given); and a Radiation 14-in. "Ruben" fire—all these appliances being shown in operation. There were also a Nautilus "Sentry" coke-boiler, a Cannon 10-gallon wash-boiler, and a Davis "Burn-All" incinerator. At several other stands gas appliances were also to be observed in operation—among them a Fletcher hot-plate for fish frying and a Main No. 5 cooker.

Then, of course, there were the competition and demonstration rooms. For the army cookery competitions, there were six No. 5 Main cookers and two of Ewart's "Califonts," all at work; while in the demonstration kitchen there were two Main No. 5 cookers, a "Ranelagh" cooker, and a Potterton No. 51 combination set, connected-up. Messrs. James Stott and Co., of Queen Victoria Street, also showed their latest gas-utilizing specialities for water heating, &c.

Altogether it was a thoroughly convincing display of the indispensability of gas in connection with culinary operations.

ELECTROLYSIS.

Research Work on Stray Currents.

The question of vagrant electric currents and their attack on metallic bodies below the surface of highways and by-ways in our towns is of interest, says the "Journal des Usines à Gaz," to those responsible for the distribution of gas and of water, and for the postal and telegraph services. Many conferences have been held jointly by the sufferers from, and the originators of, these mischievous currents; and latterly the matter has been taken up by official commissions. As a result of the considerable development in electric traction for public conveyance above and below ground, the gas-mains of Paris have naturally been widely attacked by stray currents; and the "Société du Gaz de Paris" has recently reorganized its department for combating the trouble, and has established a research section with a fully-equipped laboratory under the direction of M. Chappuis, Physics professor at the Ecole Centrale des Arts et Manufactures. The following translation is of communications by MM. Chappuis and Hubert-Desprez to the Académie des Sciences, which described the interesting work they had accomplished towards the tracing and extermination of these underground enemies.

I.

Stray currents originate in the ground from the faulty insulation of electric cables, and in Paris particularly from the network of mains which provide direct current at 550 volts for the public transport services. In closing their circuit back to the generating station, these stray currents take the line of least resistance, usually the underground gas, water, and compressed air mains, in leaving which they cause serious trouble; eating away the metal and actually causing perforations and serious escapes of the fluid contents.

To the best of the writers' knowledge, no exact method of establishing with certainty the origin of stray currents exists, desirable though it be to trace the defective insulation and remedy the evil. Accordingly they undertook, at the Electrical Laboratory of the Société du Gaz de Paris, experiments of which the first results are published below.

If a stray current is picked-up in the circuit of an ordinary telephone receiver, by the agency of a transformer, a sizzling noise is heard from which, by careful listening, one can pick-out different sounds corresponding to the quick variations in the current taken by the tramway motors, or in the revolutions of those motors. This observation led to an attempt to pick-out the sound produced by the brushes of the station generator. As the latter runs, as a matter of fact, there is produced a regular mechanical phenomenon, the result of the brushes on the segments of copper and of insulation between them. Mingled with the motor sound, the listener can distinguish a hum the vibrations (N) in which are the product of the number of segments in the generator's commutator and the number of revolutions per second the latter makes. At the same time there are imparted to the current from the dynamo feeble waves whose number is also equal to N. These sound waves reach the telephone as part of the "sizzling" noise ascribed to stray currents. If this wavy current is collected by receiving apparatus which combines an amplifier specially constructed and tuned-up for frequencies of 100 to 4000, it is possible to isolate from the general buzzing and recognize the N-vibration sound of the generator.

Tests were made on two machines in which N was 928 and 3240 respectively. Leakages were arranged and the ensuing stray currents picked-up, in which the respective vibrations were recognizable at the receiver by the assistance of a special recording instrument. This showed the possibility of this method of tracing the source of stray currents; but it was realized as insufficiently definite in view of the great number of dynamos on the mains which would give values of N varying but very little.

The encouraging results of this work led the writers to think it would be feasible to superimpose on the main current from the generator electrical disturbances which would indicate the particular source of a stray current—such disturbances being of a wave-length attuned to N, and so within the field of the receiving apparatus. Accordingly, they arranged a thermionic valve of which the plate circuit was shunted over the terminals of the generator while the grid received, through a transformer, currents controlled by a Morse key or, in preference, by a microphone. By varying at will the latter, variations in the plate circuit are set-up which are reproduced in the main circuit, and, consequently, in the vagrant currents. In their experiments with the particular machines mentioned above, they were able to pick-up Morse signals, a whistle, and even words; and the inclusion of this apparatus showed a negative result except on the two dynamos known to be originating stray currents. By its application any leakage can be traced to the source of generation.

II.

MM. Chappuis and Hubert-Desprez next outlined experiments and observations they had carried out on electrolytic action taking place in soil; their object being to establish results by experiment applicable to, and informative of, particular conditions found in pipe-lines that had been attacked by stray currents.

The investigators pointed out that perforations found in a steel or lead pipe may be taken as due to the electrolytic action of

stray currents, the pipe taking the part of the anode—that is to say, it is the positive terminal in respect of neighbouring conductors or of the soil surrounding it. The mischief might also be attributed to local "couples" set-up by impurities existent in the metal of the pipes. It is of great importance to assign the responsibility to one or other of these causes, so as to proceed correctly to counteract the trouble; and it would appear that the selection is facilitated by careful observation of the perforation, together with the resultant products, and their distribution over the line and in the soil around.

To this end, the writers undertook experiments on electrolysis in earth. The first tests were carried out in special vessels filled with likely sand or soil, which gave certain information, but presented difficulties in selecting products for analysis. More satisfactory results were obtained by using flat glass containers about three centimetres deep, as it was thus possible to observe a complete section of soil in which patches of colour varied between anode and cathode; the deductions and analyses being applicable to the question before them.

Finally they hit upon a method which gave far better results. It consisted in an X-ray examination of the electrolytic action of a current passing through soil or saw-dust in a wooden container. This allowed uninterrupted observation of the phenomenon developing and the taking of X-ray photographs of every interesting phase; while the opening of one side of the container showed the state of the electrodes and the distribution of the products of attack from the anode. Thus the analyses to be made in actual practice may be assessed to a certain extent, and the work facilitated by the photographs and by direct observation.

This study was carried out with electrodes of copper, iron, and lead; the electrolyte being a salt of the metal or a solution of sodium chloride. A Daniel battery was also used with the cells filled with earth soaked in copper sulphate and zinc sulphate respectively, enabling observations to be made of the phenomena set-up in porous impregnated solids; and finally experiment was made with a block of reinforced concrete.

It was plain from the above that electrolysis taking place in the ground proceeds very differently from that in a liquid; and, as the first example, the results with the copper electrodes may be examined. In the electrolysis of copper sulphate with copper electrodes, the variation in weight of the cathode is always far below that of the anode. The first deposits of metal touch the cathode without strongly adhering to it; and the metal stretches out from the cathode towards the anode till finally a short-circuit is estab-

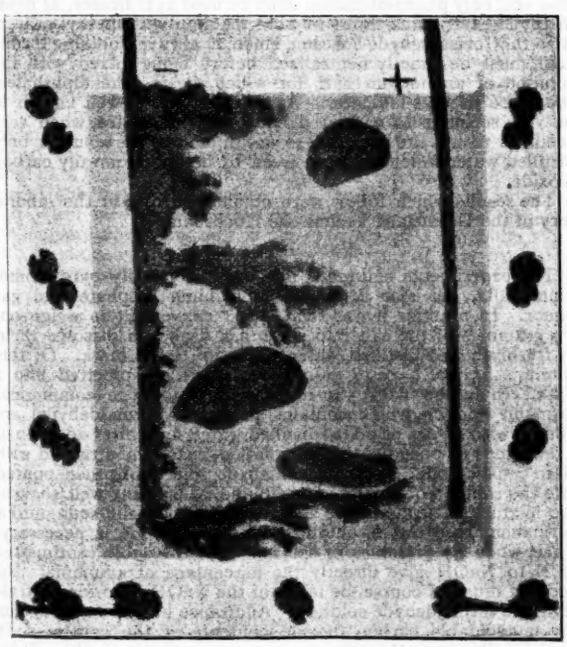


Fig. 1.

lished. This is shown in fig. 1—the action proceeding in stony earth, and solid copper sulphate attached to the anode. In fig. 2 can be seen the effect of electrolysis in earth impregnated with sodium chloride, with copper electrodes. A solution of soda mixed with sodium chloride forms round the cathode, which remains unaltered. The anode is covered with a white mass of cuprous chloride, then a green patch of cupric chloride, while a solution of the latter salt diffuses through the soil and, towards the middle of the container, makes contact with the solution of soda. There now gathers a deposit of copper hydrate, which is the first curve (seen in fig. 2) traced out between the electrodes; and this deposit would seem to serve as an intermediate cathode, for there forms by electrolysis of the dissolved cupric chloride metallic copper which (as before) stretches out towards the anode. Fresh

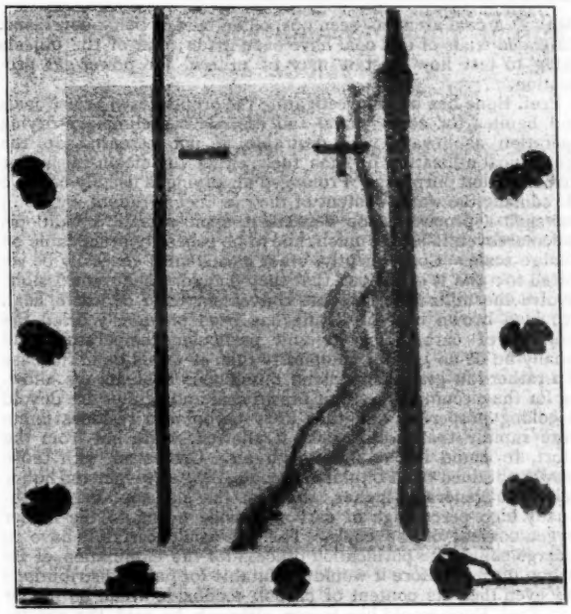


Fig. 2.

curves may then be noticed springing up between the one first observed and the positive pole, till finally they make contact with it. All are of copper hydrate interspersed with metallic copper.

The progress of these two experiments was successfully followed without interruption by direct observation and X-ray photographs.

BROWN COALS AND LIGNITES.

Their Utilization for Gas Making.

A paper was read before the Dominions and Colonies and Indian Sections of the Royal Society of Arts on Friday last, by Prof. W. A. Bone, F.R.S. (Professor of Chemical Technology, Imperial College of Science and Technology, South Kensington); the subject being "Brown Coals and Lignites: Their Importance to the Empire." Viscount Elveden, C.B., C.M.G., M.P., presided.

In the paper, Prof. Bone drew attention to the enormous deposits of brown coals and lignites in many of our dominions, which, owing to the fact that they are so near the surface, can be mined at a low cost, compared with that of mining black or bituminous coals. As an instance of the extent of these deposits, it is said that of the estimated Canadian coal reserves, which amount altogether to 1,234,269 million tons, no less than 1,072,627 million tons are of a sub-bituminous lignitic class. Also, the Morwell deposits in Australia are of phenomenal thickness, and without parallel elsewhere in the world. It is estimated that within an area 50 miles long in the Latrobe Valley (in which Morwell is situated), and within 1000 ft. of the surface, there are over 31,000,000 million tons of brown coal. There are also extensive deposits in New Zealand, India, Burma, and in the Malay Peninsula.

The characteristic properties of brown coals and lignites are that: (1) In the raw state they contain a large amount of water, generally more than 20 p.ct., and sometimes as much as 50 p.ct.; (2) on losing that moisture by air drying they usually disintegrate, either crumbling to powder, or developing well marked laminar cracks; (3) they are devoid of coking properties; and (4) in the dry, ashless state they usually contain less than 75 p.ct. of carbon and more than 20 p.ct. of oxygen, and on carbonization at 900° C. they yield upwards of 45 p.ct. of volatiles. Bad as is the natural high water content of raw lignites from a steam-raising point of view, it is still worse from that of carbonizing them for gas making under bye-product recovery.

It hardly needs an experienced gas engineer to show the impracticability of carbonizing, either in retorts or chambers, a coal containing anything from 20 to 50 p.ct. of water, or to foresee the formidable difficulties that would be encountered in attempting to recover tars and light oils from the steam-laden gas that would issue from the retorts. Therefore, said Prof. Bone, it may be taken for granted that any scheme for carbonizing such coals on a large scale ought at least to include some preliminary drying process. There are, however, compensating advantages, in that lignite and brown coal deposits can be raised at low cost; that some lignites are capable of yielding, on low-temperature carbonization, a variety of valuable bye-products; and that, if subjected to suitable heat treatment, they may be transformed into more efficient steam-raising and gas-making fuels than might be supposed from their natural low-grade character. At Rawang

(Malay) a coal area has been opened out and is being developed. Extended trials of this coal have been made; one of the objects being to test how best it may be utilized for power-gas production.

Prof. Bone has been investigating the properties of brown coals and lignites for some years, and regards a preliminary drying operation as always very desirable, if not essential, to the economical utilization of such fuels, either for steam-raising or carbonization purposes. Prolonged air drying is usually capable of reducing the water content of the raw fuel to about 15 p.ct.; but such a process is too dependent upon climatic conditions, and, moreover, takes too much time to be generally practicable on a large scale. Consequently, other means must generally be resorted to; and it is obvious that they should, whenever possible, involve the utilization of some convenient form of waste heat. Provided brown coal or lignite has been previously dried, the problem of carbonizing at any particular temperature will usually be of no greater complexity than it would be in the case of a rather low-grade non-coking bituminous coal, always allowing for the circumstances that brown coal and lignites are devoid of coking properties, and that their carbonized residues ignite more rapidly than would coke if allowed, while hot from the retort, to come into contact with air. Compared with those usually obtained from bituminous coals, the gas-weight and liquor yields are generally higher, although the gas contains an unusually high percentage of carbon dioxide, owing to the higher oxygen content of the coals. The gas would certainly have to undergo some lime purification process for the elimination of its carbon dioxide before it would be suitable for public distribution; and even then its content of carbon monoxide would be higher than Prof. Bone would like to see, although, he said, the gas industry would probably view them with equanimity, if not with positive delight. Also, the author said there is no particular difficulty about gasifying lignites in producers, and with good results so far as the quality of gas is concerned. As an example, he quoted the results of such trials carried out by the Power Gas Corporation, Ltd., upon French and Italian lignites in a Mond bye-product peat gas producer plant:

	French Lignite. P.Ct.		Italian Lignite. P.Ct.
Moisture in coal charged	40·5	..	8·5
The dry fuel contained:			
Fixed carbon	33·9	..	—
Volatiles	50·1	..	—
Ash	17·7	..	16·2
Nitrogen	1·8	..	1·9
Yield of gas:			
Cubic feet at 15° C., per ton dry fuel	78,300	..	71,700
	P.Ct.		P.Ct.
Composition of the gas:			
CO_2	20·8	..	16·3
CO	10·6	..	11·5
H_2	25·6	..	26·3
CH_4	5·4	..	4·8
N_2	37·6	..	50·1
	100·0	..	100·0
Yield of ammonium sulphate in lbs. per ton of dry coal	92·5	..	130

Some discussion followed the reading of the paper; but the speakers kept clear of the problem of the utilization of these brown coals and lignites for the purpose of gas making.

Straw Gas Plant at Arlington.

When dry straw is sufficiently heated in a closed retort, gas is given off which is very similar to coal gas, while the bye-products, says Mr. Harry E. Roethe, of Washington, consist of carbon char or residue, tar, and ammoniacal liquor. Realizing the possible application of such a process to farming and rural communities, the United States Department of Agriculture have installed (for experiments by the Bureau of Chemistry) a small gas-producing plant on the Government farms at Arlington (Va.). The retort, which is 8 ft. long and 3 ft. in diameter, accommodates a maximum of about 200 lbs. of unbaled straw. A scrubber 7 ft. high and 2 ft. in diameter, partially filled with water, is equipped with several screens and a quantity of coke, to give a more effective and greater scrubbing surface. There is a 100 c.ft. holder. Gas begins to come off when a temperature of about 200° C. is reached; the maximum production being between 500° and 600° C. After passing from the retort through a 6-in. pipe to the scrubber, where it is cleaned, the gas goes straight to the holder. Based on the results of Canadian experiments, a ton of sun-dried wheat straw produces approximately 10,000 c.ft. of purified gas, 600 to 650 lbs. of carbon residue (which may be readily powdered to a very fine consistency), and about 10 gallons of tarry liquid. The gas has a calorific value of about 400 B.Th.U., burns with a blue flame in a bunsen burner, and has a slight odour. The combustible constituents of the gas are carbon monoxide, methane, and hydrogen. Tests have shown that straw gas gives a very good light when used in gas-mantle lamps, and that its use with gas hot-plates, stoves, and heaters is very satisfactory. Excellent results have been obtained with the gas as a source of power for operating stationary internal-combustion engines. In this connection, the gas apparently proves most satisfactory when mixed with little air and ignited under a compression slightly greater than that found in the ordinary stationary gasoline engine.

QUANTITATIVE DETERMINATION OF AMMONIA.

A Method without Distillation.

[Dr. A. SANDER, in "Das Gas- und Wasserfach," Nov. 19, 1921.]

This article appeared in our German contemporary as a product of the Technical and Electro-Chemical Institute of the Technische Hochschule, Darmstadt.

GENERAL.

In gas-works and coke-ovens it is the general practice to determine the ammonia contents of ammonium salts or liquor by means of the old distillation method, by which the ammonia is set free by an excess of caustic soda, distilled off, and absorbed by a measured quantity of titrated sulphuric acid. The objections to this method are the time it occupies, owing to the long time the ammonia solution must be heated, and also the fact that a separate distilling apparatus is needed for each test; so that in big laboratories, where day after day many have to be made, often ten or more are working at the same time.

In the chemical industry, another process has been introduced in recent years which permits of the determination of ammonia quickly, accurately, and without waste of time and special apparatus. It is founded on the well-known reaction of ammonia and formaldehyde to form hexamethylene-tetramine, according to the equation

$$6CH_2O + 4NH_3 = (CH_2)_6N_4 + 6H_2O.$$

The reaction is exactly similar if an ammonia salt be used, such as ammonium chloride, and formaldehyde:

$$6CH_2O + 4NH_4Cl = (CH_2)_6NH_4 + 6H_2O + 4HCl.$$

Thus the formaldehyde takes from the ammonium salt the ammonia required for the formation of the hexamethylene-tetramine; while the acid is set free, and can be measured by titration with an alkali.

This reaction was observed and described by Delépine as long ago as 1895; but he found that, when using the stochiometrical quantities of formaldehyde and ammonium salt, the reaction was reversible, so that the acid was only partially set free. Shortly afterwards, Cambier and Brochet showed that, by using an excess of formaldehyde the whole of the acid in the salt could be freed. From this, Ronchèse worked out a practical method of determining the ammonia in ammonium salts. He found that a fairly large excess of formaldehyde is required, and that in the titration of the free acid only phenolphthalein must be used as indicator, as hexamethylene-tetramine shows an acid reaction with methyl orange. Also the formaldehyde solution, since it always contains formic acid, must be exactly neutralized before being mixed with the solution of ammonium salt, for which, again, phenolphthalein should be used as indicator. As this indicator is well known to be very sensitive to carbon dioxide, it is important, when very accurate results are required, to use in making the solution only distilled water which has been freed by boiling from any carbon dioxide.

The results which follow were obtained in 1919 in the laboratory of the Darmstadt Technische Hochschule.

EXPERIMENTAL.

The experiments embraced not only chemically pure ammonium salts, but also technical ammonium sulphate and gas liquor. In practice it was found most convenient to weigh out 1·7 grammes of the salt into a 250 c.c. flask and dissolve them in freshly-boiled distilled water, filling up to the mark. Of this solution, 25 c.c. (= 0·17 grammes of salt) are pipetted into a flask. In another flask, 5 to 10 c.c. of formaldehyde (commercial formalin solution, which contains 40 p.ct. of formaldehyde) are diluted with 20 c.c. of boiled distilled water, and, after addition of a few drops of phenolphthalein solution, exactly neutralized with N/10 caustic soda. This formaldehyde solution is then poured into the solution of ammonium salt, and, after being well shaken, the mixture is titrated once again with N/10 caustic soda until a permanent rose tint is obtained. No calculation is necessary, since, when 1·7 grammes of salt are used, the cubic centimetres of N/10 NaOH give directly the percentage of ammonia. No account must, of course, be taken of the NaOH used for neutralizing the formaldehyde solution. Allowance has to be made for the unavoidable carbon dioxide contents of the caustic soda used for titration, otherwise the average ammonia results will be found rather too high. To avoid this, the caustic soda need only be titrated against N/10 hydrochloric acid, again using phenolphthalein instead of the usual methyl orange. The factor obtained should then be used in every test, as explained in detail later.

PURE AMMONIUM SULPHATE.

The analyses of several ammonium salts are then described, beginning with pure ammonium sulphate. A solution was made up to 250 c.c., containing 1·7 grammes of the salt, and 25 c.c. of this solution used. After adding 5 c.c. of neutralized formaldehyde solution, 26·65 c.c. of N/10 caustic soda were required in the titration. The NaOH was then compared with N/10 sulphuric acid with methyl orange as indicator, and agreed exactly.

NOTE.—This method was proposed in this country for estimation of ammonia in ammonium salts, and also for the estimation of sulphur in the solution obtained from the Referees' method for estimating sulphur in coal gas. See "Journal Soc. Chemical Industry" (Blair), 1911, 30, 397.

But, using phenolphthalein as indicator, there were required for 10 c.c. of the acid not 10, but 10·3 c.c. of NaOH, owing to the carbonate contents of the latter. This means that the caustic soda has for phenolphthalein the factor 10 ÷ 10·3 = 0·97. The 26·65 grammes mentioned above have now to be multiplied by this factor, which gives 25·85 grammes of NaOH used, corresponding to 25·85 p.ct. of ammonia in the salt. The theoretical value is 25·78, so that the result found agrees very well. Three further tests by this method gave 25·72, 25·93, and 25·77 p.ct. of ammonia, and a check test by the usual distillation method gave 25·74 p.ct. It is clear from these results that on no account must the carbon dioxide in the caustic soda be forgotten, as the uncorrected value of 26·65 is almost 1 p.ct. above the real quantity of ammonia. And if old NaOH is used, it may contain still more CO_2, and the error be considerably greater.

THE CHLORIDE AND NITRATE.

Pure ammonium chloride was next tested by the formaldehyde method, which gave ammonia percentages of 31·75, 31·66, and 31·90, against the theoretical percentage of 31·83. Check tests by distillation showed 32·03 and 32·12 p.ct. of ammonia. In the same way, results from pure ammonium nitrate were 21·06 and 21·13 p.ct. of ammonia, against the theoretical value of 21·25. Tests by the old method showed 21·27 and 21·29 p.ct.

COMMERCIAL AMMONIUM SULPHATE.

In analyzing commercial salts by the formaldehyde method, it is necessary first to make sure that the solution has a neutral reaction. In the case in question, the salt contained 1·3 p.ct. of free sulphuric acid, and a small quantity will generally be found. It must, therefore, be first exactly neutralized with N/10 caustic soda, using methyl orange as indicator. Then the formaldehyde solution is added, and again neutralized with N/10 NaOH, this time using phenolphthalein as indicator. The presence of two different indicators does not in any way interfere with the titration, as the appearance of the rose tint is quite easily recognized, even in the yellow solution. It is possible, however, to proceed in another way. Without first neutralizing the ammonium salt, the formaldehyde solution can be added, and the titration with phenolphthalein as indicator performed. Then a second separate quantity of the ammonium salt solution can be titrated, using methyl orange, and the quantity of NaOH deducted from that used in the first titration in making the ammonia calculation.

Example.—25 c.c. of solution used, representing 0·17 gramme of ammonium sulphate. To neutralize this was required 0·45 c.c. of N/10 NaOH (using methyl orange). After the addition of 5 c.c. of neutralized formaldehyde solution, 25·3 c.c. of N/10 NaOH were used for the titration with phenolphthalein as indicator. The factor for the CO_2 in the NaOH solution used was still 0·97, which reduces the quantity required for neutralizing the solution to 24·54 c.c., representing 24·54 p.ct. of ammonia in the sulphate. A check by the distillation method showed 24·43 p.ct., so that the agreement was fairly good, although in this case the distilled water was not first boiled-up. This precaution can often be omitted in practice, especially if the water is freshly distilled. It is advisable to take it, however, if the water has stood for some time. But care must be taken that it is allowed to cool down to the temperature of the air, as the reaction of ammonium salts with formaldehyde is different in the presence of heat from that at ordinary temperatures.

GAS LIQUOR.

The gas liquor tested was from the municipal gas-works in Darmstadt. It was bright yellow in colour, and at 15° C. had a specific gravity of 1·020. By direct titration with N/10 acid, the volatile ammonia was found to be 1·04 p.ct. The test for the total ammonia by distillation, after the addition of caustic soda, gave 1·17 p.ct. of ammonia. This meant that the fixed ammonia present in the liquor was only 0·13 p.ct.

The following is the procedure for determining the total ammonia without distillation: First 10 c.c. of the liquor are pipetted into a flask, diluted with distilled water, and the volatile ammonia determined in the usual way by titration with N/10 sulphuric acid, using methyl orange as indicator. In the case cited as an example, 62·4 c.c. of N/10 H_2SO_4 were required. The solution is heated-up, and kept at the boil for about five minutes, to drive-off the carbon dioxide and sulphuretted hydrogen. The flask is then corked up, and cooled to room temperature under the tap. Next 10 c.c. of neutralized formaldehyde solution are added, and the whole titrated with N/10 caustic soda to a permanent rose tint. For this, 67·0 c.c. of NaOH were required. Taking 0·97 again as the correction factor for the carbonate contents of the NaOH, the volume of the latter is reduced to 65·0 c.c., corresponding to 1·08 p.ct. of ammonia. A second test gave the total ammonia as 1·20 p.ct.; the average of these two agreeing therefore very well with the 1·17 found by the distillation method.

In the case of liquor also, the calculation can be considerably simplified by running exactly 17 c.c. from a burette into a 100 c.c. flask, filling up to the mark with distilled water, and using 10 c.c. of this each time in the manner described above.

Manchester and District Junior Gas Association.—There is to be a visit of members of the Association next Saturday, March 4, to the works of General Gas Appliances, Ltd., Guide Bridge, Manchester. After the inspection and tea, a paper will be read by Mr. D. T. Livesey, of Stretford, on "Card System Records in the Distribution Department."

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

A Second Short Paper Evening.

The second short-paper evening for this session of the Association took place last Friday evening at the Westminster Technical Institute, Vincent Square, S.W., when, as was the case at the December meeting, three contributions of a varied character were submitted, which gave rise to lively and practical discussions, some points from which, together with the papers themselves, will be found reproduced in this issue. In the absence through indisposition of Mr. F. A. Frost (the President of the Association), the chair was filled by Mr. D. C. CROSS, of Lea Bridge, the Senior Vice-President.

The authors and titles of the papers were as follows:

Mr. A. BROADBENT, of the Gas Light and Coke Company, "Some Notes on Labour Analysis."

Mr. SAMUEL B. CHANDLER, of the South Suburban Gas Company, "The Application of Town Gas for Bulk Hot Water Supply, Central Heating, and Steam Raising Purposes."

Mr. W. L. WESTBROOK, of the North Middlesex Gas Company, "Gas-Fires and their Ventilation, with Special Reference to Cavity Flues."

The CHAIRMAN remarked that the evening's proceedings were bound to be of practical substantial help to the members. The three gentlemen who were going to introduce the discussions were all well known to the members.

At the close of the discussions, the CHAIRMAN proposed a hearty vote of thanks to the authors.

Mr. D. J. WINSLOW (Lea Bridge) seconded the vote, which was heartily accorded.

YORKSHIRE JUNIOR GAS ASSOCIATION.

The Sale of Gas by the Therm.

A Meeting of the members of the Yorkshire Junior Gas Association was held on Saturday, February 18th, at the Metallurgical Department of the Leeds University, under the presidency of Mr. PETER M'NAB (Low Moor).

The PRESIDENT said there was no need for him to introduce the author of the day's paper—Mr. S. T. S. Musgrove, of Sheffield—one of the younger members of the Association, who had prepared a paper at short notice, and had taken as his subject one of the most up-to-date and important phases of the industry.

Mr. S. T. S. MUSGROVE then read the paper on "Selling Gas by Therms," which will be found on p. 447 of last week's "JOURNAL."

DISCUSSION.

The PRESIDENT said the members would all agree they had heard a paper of much value, and would greatly appreciate the large number of suggestions Mr. Musgrove had made as to how to sell gas they had made. If they did not have good salesmen, it was quite certain they would soon have to shut-down. Mr. Musgrove had given hints of more up-to-date methods of sale than many of them had applied hitherto.

Mr. J. W. HOLROYD (Huddersfield) said he had been asked to voice a few ideas which had occurred to Mr. E. L. Oughten, of Huddersfield, one of their Past-Presidents, who was unable to be present, but who had read the paper in advance. In regard to the gas sales department, Mr. Musgrove rightly emphasized the importance of the selling side of gas undertakings. He would, however, venture a step further, and say that the sales side always had been of the same importance as to-day, though this was not always recognized in many quarters. The old-school managers had in many cases to be "Jacks of all trades, and masters of one." There was no excuse for this state of affairs to-day; and with the development of specialized training in the different sections of the industry, one might repeat, "To every man his work." The practical super-man for all departments was very rare indeed. In the matter of the therm basis, the heat-unit basis of charge would remedy, as Mr. Musgrove had pointed out, the obvious unfairness of charging the same price for gas which did not perform the same work, although perhaps the meter registered it without discrimination. As to lighting, he would like to ask whether Mr. Musgrove found he could fit-up a new high-pressure gas-lighting installation more cheaply than electricity. It had been seen recently that the initial outlay of a high-pressure gas-lighting system was rather high, though of course it included more, and renewals were limited mainly to mantles, whereas renewals with electric lighting meant new lamps. Regarding cooking, he would ask Mr. Musgrove if the use of flat-flame burners in an oven did not necessitate more ventilation than when non-luminous bunsen flames were employed which took in air from outside the oven. On the subject of fires, had Mr. Musgrove found much difficulty in combating the indiscriminate use of flueless stoves in bedrooms? In spite of "B.C.G.A." circulars and advertisements, a leading authority on ventilation reported favourably on a certain type of flueless fire, giving the impression that these might safely be used. Mr. Musgrove had pertinently pointed out the necessity of salesmen knowing their business and their goods. Yet there was much harm being done to the extended use of gas appliances, owing to far too much attention being paid to appearance and price, instead of to intrinsic efficiency of the apparatus. Not all towns were favoured by having such a wide field for gas-furnace work as existed in Sheffield; but there were certainly many industrial and trade uses of gas which

presented an almost virgin field for future development, in practically every area of supply.

Mr. Musgrove said the cost of a new installation of high-pressure gas, as against that of electric lighting, depended largely on the construction of the building to be lighted. From a labour-saving point of view, it was, of course, easier to run wires than piping. Further, unfortunately for people at times, it was still permissible to run unprotected wires. The wires were not always put into casing, and this saved cost; but provided the installation was carried out under fire insurance rules, high-pressure gas lighting need not be any more expensive to instal than electricity. With regard to the extra ventilation necessary for luminous flame burners, as against atmospheric burners, he did not think there should be any difficulty in this direction, if the same quantity of gas per hour were consumed. He did not think any greater quantity of air should be required for combustion, whatever type of burner might be used. The important thing was adequate provision for the flueing-out of the products of combustion. He had been surprised by the demand there had been for these oven squares to convert an ordinary coal-range oven into a gas-oven, though he admitted that a proper gas-cooker was preferable where there was room for it. It was in the small houses that these squares were useful. With regard to flueless heaters, he felt he could not emphasize too much the harm they were doing. He sincerely hoped that no responsible representative of any gas undertaking present would ever sanction or approve the installation of a flueless heater for any living-room. Where gas was consumed, there must be products of combustion; and they had to be got rid of somehow. Flueless heaters might be suitable for passages, corridors, vestibules, &c., or perhaps for large workshops; but for domestic establishments and small shops, if that was the only type of gas apparatus people would instal, they were better without gas. Flueless heaters in small places would, he was sure, cause trouble.

Mr. J. Kennington (Grimsby) said the hint as regards instruction of the staff was very useful; and a point might be added as to the instruction of the public. Where the Gas Regulation Act was adopted, the gas undertaking had to send an official notice to the consumers informing them of the change in the method of supply; but the people did not know what it meant, and the situation ought to be explained by some suitable pamphlet, advertisement, or reference in the newspapers, showing the value of selling gas by heating value instead of by volume. A very troublesome matter was the frequency of gas poisoning; and people were "getting the wind up" about it. There again, if the undertakings informed the public, by means of letters or pamphlets, that the danger of gas was not in the slightest degree increased, and that the characteristic odour was still to be smelt, it would be extremely helpful to the selling side. Mr. Musgrove had mentioned the value of the gas department being in the field first. In his (Mr. Kennington's) own experience, recently his town had a new Medical Officer of Health. The former officer had been there a long time, and was rather old-fashioned in certain ideas. He (Mr. Kennington) took an early opportunity to call on the new official, and offered the services of the gas department in any matter he might have to deal with connected with the use of gas. Very quickly the department had three gas-fires in the Medical Officer's own offices; and since then they had installed three more.

Mr. F. Clegg (Huddersfield) said he would be glad if the author could say how, and when, he would propose to educate the outdoor-staff. He (Mr. Clegg) believed very few men of the outdoor staff—he doubted whether there would be 10 p.ct.—understood what was a therm, or what a B.Th.U. represented. Would Mr. Musgrove educate them in working hours or require them to attend a course of lectures in their own time? He himself had considerable doubts as to the attendances he would get if under the latter conditions. In regard to the square burner for use in existing range ovens, in Huddersfield they had accomplished something similar by putting into the oven an ordinary gas-ring, but of larger size than usual; leaving the oven door ajar sufficiently to take the piping to carry the gas. The idea had yielded very excellent results.

Mr. Musgrove said, with regard to educating the public, when his undertaking changed over to the therm basis they issued pamphlets, somewhat on the lines of those of the "B.C.G.A.," explaining the new method of charging under the Act of 1920 and what a thermal unit was. They pointed out that the gas—owing to the necessity of keeping above the required value, to avoid risk of being below—would actually be of higher quality than the 400 B.Th.U. declared and charged for. They sent this pamphlet to every consumer; but despite the information so distributed, he was still prepared to agree that, if an undertaking could say at present that 10 p.ct. of the staff thoroughly understood the advantages of working under the Act, they were doing very well. As to the carbon monoxide scare, he thought Dr. Carpenter had put the matter as well as it could be put, when he said: "Gas is made to be burned, not to be breathed." The carbon monoxide content of gas to-day was no more than it had ever been, and was considerably less in a good many undertakings than during the war period and the coal stoppage period. Personally, he thought this sudden scare would die down. Regarding the education of the outdoor staff, his own method had been to give a short lecture to the fitters and the showroom and distribution staff during the first half-hour in the morning. If they were asked to come in their own time, the attendance might not be very large. Fifteen or twenty minutes spent in explaining in simple language, first of all what a B.Th.U. was and then what a therm was, and also the relationship between B.Th.U. or therms and cubic feet, was very useful. He always invited discussion, and he had got it. This was the most interesting part of the business. He believed the fitters and others were anxious to understand what the change meant; and the way to make them understand was to let them talk about it, because then they asked questions. At Sheffield, they carried out the same thing with regard to any new appliance which came along from time to time. With regard to the gas square, he did not claim that it was new or original. Some method of gas-heating for existing coal-range ovens had been tried in a number of places. The reason they in Sheffield put the square inside the oven, rather than having the heating in the centre, was that they considered they got better heating this way. The important thing was proper provision for flueing-out the products of combustion. At Sheffield they had recording calorimeters fitted-up in the works, and eventually would have two on the district; so that there was no possibility of the public losing anything by the new system. The minimum B.Th.U. value had to be maintained; and in order not to drop below the minimum, it was as well to keep above it. The consumer gained thereby, and, indeed, was more fully protected than ever before.

The President referred to four brief but important points in the paper that every official or employee whose duty brought him into contact with the public should be able readily to explain: (1) What a B.Th.U. is; (2) what a therm consists of; (3) the meaning of gas of a stated B.Th.U. value; and (4) the relationship between B.Th.U. or therms and cubic feet. The public needed educating on these points. A better method of public education than handbills or pamphlets would be to put the explanation on the meter card, so that the public would not destroy the information.

Mr. Musgrove agreed that the idea was very good. The meter reader himself, of course, was supplied with a conversion table, so that he could see the equivalent in therms and cubic feet. If he could tell the public right away what they had consumed, it would be very useful to them and to the industry.

Mr. H. Wild (Bradford) apologized for the unavoidable absence of Mr. S. H. Packer (head of the Bradford gas showrooms), and said he would like to associate himself with the remarks of the author of the paper on the subject of salesmanship, and also in relation to advertising by a gas undertaking. The possibilities of development of the sales of gas and its appliances were not confined to any particular department of the undertaking. This, of course, was a very valuable point in favour of the gas undertaking, if properly cultivated under a system of successful interlocking of the departments, so that every operation on the selling side forged a link between the undertaking and the consumer. The gas undertaking could have as salesmen such a wide variety of influences as fitters, plumbers, inspectors of meters, lighting, maintenance, &c., as well as the office staff, if all these people were made to know the policy of the sales department. While many industrial concerns had to pay thousands of pounds per year for what might be termed "obtaining entrance," the gas undertaking could secure at no cost at all entrance to at least 80 p.ct. of the private and business premises in their area of supply. The meter inspector or complaints inspector or other outside man could hardly be expected to educate the public, in addition to his ordinary duties; but it should not be difficult to esfablish a system whereby each employee coming into contact with the public became an extra salesman. Every employee should know that the undertaking's object was to sell, combined with giving satisfaction. They should know that each report of defects and faults, or inquiry received through any one of them, was an advertisement as good as a sale. A complaint meant special efforts to remedy it; and if there was not immediate financial gain, there was a great advertisement in the form of a satisfied consumer. A satisfied consumer was a real live travelling advertisement of the uses of gas. It was largely a question of enthusiasm among the employees; and better business for the undertaking meant better business for the employees. Every employee should understand that he formed a link in a great selling chain, and a link in a chain of co-ordination in the knowledge of the public of what gas could do. First advertise the policy, the salesmanship, and the goods inside the department, and the advertisement would quickly multiply outside.

Mr. Charles Roper (Bradford) said good service to the public was essential, and the lethargic staff man must not be tolerated. He quite agreed that fitters, plumbers, inspectors, &c., should know the policy. All employees should do so. Unfortunately, a gas department came across cases sometimes where appliances were not satisfactory. Recently he had seen a supply run from the meter in the cellar to the drawing room with ¾-in. pipe intended to feed a 14-in. fire. Infinite harm was done in cases where a supply-pipe was put in which would be insufficient to meet the full needs of the consumer; and the master plumber did not know, and the department did not know. He agreed with the President's idea as to printing on the meter card information about the therm.

Mr. W. Brook (Leeds), dealing with industrial uses, said the gas-furnace was certainly reaching a higher standard of efficiency; and he looked forward to the time when double the 40 p.ct. mentioned by Mr. Musgrove would be attained. He urged the value of practical demonstrations in furnaces to anybody interested, and thought much good came out of the holding of exhibitions. He urged more frequent advertising in the Press, and felt there was a great future in store for gas for industrial uses—especially in view of the improvements which might be expected from the research work now proceeding. He admitted that some furnaces were not creditable to-day. They simply passed the gas in and out again, losing a great portion of the heat. Improvements were needed in refractory materials. A temperature of 1800° C. could be obtained in an air-blast furnace; but the linings would not stand it. This was unfortunate from the selling point of view, because the necessity for frequent renewal might prejudice sale. They needed less ironwork and better brickwork. The life must be lengthened, and the cost lowered.

Mr. Musgrove, replying, said he believed the quality of refractory materials in this country was improving, and several important firms were giving very serious consideration to the matter. It was the cost to-day that killed the very best refractory.

Mr. W. Heathcote (Halifax) said he had been experimenting with furnaces, and had obtained a temperature of 1400° C. in the muffle. The Germans made a refractory capable of standing very high temperatures. Referring to the oven square, he asked if it had been found necessary to alter the shelves in order to get a satisfactory distribution of heat.

Mr. Musgrove said the solid shelves of the coal-range oven were unsuitable; and if these could be cut to allow the heat to pass, it would be advantageous. It could be done by taking an inch off the shelf at either end. Where shelves could not be cut, smaller and thinner shelves were supplied.

Mr. H. R. Lauton (Bradford) said that, where the Act of 1920 was in operation, it would be a good idea to state on the gas account, for

the first few quarters, the meaning of a B.Th.U. and a therm, giving examples of a conversion from cubic feet.

Mr. KENNINGTON proposed a vote of thanks to Mr. Musgrove, and said the paper and the discussion would be a valuable addition to the "Transactions." The motion was seconded by Mr. F. C. BRADBURY (Elland), and heartily carried.

MIDLAND JUNIOR GAS ASSOCIATION.

A Meeting of the Association was held on Thursday, the 9th inst., at the Council House, Birmingham—Mr. L. H. THOMAS (the Junior Vice-President) in the chair.

Allusion was made by the Chairman to the severe illness of Mr. R. G. Marsh (Fittings Engineer to the Birmingham Gas Department); and a resolution was passed expressing hope for his speedy recovery. It was stated that the condition of Mr. Marsh showed improvement.

Mr. LUKE STURDY (of the Birmingham Corporation Gas Department) read the following paper on

CANTEEN AND RESTAURANT EQUIPMENT.

In bringing this subject before you, I am aware that I am not breaking new ground. I feel, however, that in this direction there is an opportunity for the use of gas which will repay most undertakings for their trouble. The growth of canteens was most marked during the war, when numbers of workpeople had to be catered for in the days of rationing, when factories were built in districts where the ordinary means of obtaining food did not exist. I wish, however, to say that while war-time canteens were most essential, if they are to be continued to any great extent in peace time, when competition between the various business houses becomes keener, it will be necessary, when endeavouring to persuade firms to instal them, to ignore the lavish way in which many of them were equipped, and to remember that cost plays a very important part in the decision to-day. Do not think that it is only large firms who are in a position to run canteens. I have seen several instances where firms employing no more than forty or fifty hands do so quite successfully. Of course, the ordinary domestic cooking appliances, used in sufficient units, are quite suitable for this class of work.

THE CANTEEN A NECESSITY.

Perhaps it would be wise if we looked at some of the reasons why a canteen should be installed. Take the case of a large factory. In the ordinary way, all kinds of contrivances are used for boiling water for tea making and the warming of dinners. This means, when spread over the whole works, a great amount of time which could be better employed in productive work being wasted in these operations, besides upsetting the "following on" process of work, which is a feature of workshop practice to-day. The next point I would like to emphasize is the health of the workers. We have all seen the factory where no system exists for partaking of meals; where men sit down at their ordinary work-bench, among their tools, and surrounded by materials in all stages of manufacture, covered in many cases with grease and other deposit which is of no benefit to the human system, but which in course of time must find its way there, however careful the individual concerned may be. The question of cleanliness operates in a personal way also. How many men under the above haphazard method will take the trouble to wash their hands before taking a meal? The number is not very great; but when it comes to sitting down at a nice clean table, with other workers of the firm, they feel it is necessary to appear clean and smart.

There are other reasons which could be advanced, such as the time lost through workers living a considerable distance from the works, trying to get home to the mid-day meal, and one or other of the means of their transit either breaking down or causing delay. It will be seen, then, that it is to the mutual advantage of the employer and the workers that some organized system should be adopted whereby meals can be partaken under clean, comfortable conditions, and at a figure which will be within the reach of all concerned. Particularly is this the case with young people, who, if left without any proper provision of this kind, often fritter away the few pence they have allowed for a meal in a manner which does not provide them with very much nourishment.

POINTS IN THE ARRANGEMENTS OF A CANTEEN.

It is the contention of those of us connected with the gas industry that the conditions required for a successful service in canteens can best be obtained by the use of gas, in conjunction with the apparatus which various makers now supply. In the arrangement of a canteen, a number of points have to be considered. I will outline some of them, in the hope that it will lead to a discussion which will be helpful to all. First let me mention the question of the position of the kitchen. It is necessary to arrange that this shall be in such a situation in the building that the odours which accompany the preparation of food shall not travel to any other portion of the premises, especially if they are used as large shopping stores, or if there are a number of offices into which the public have access.

The next point is the question of light. Get as much daylight as possible into the kitchen. Food prepared in a semi-dark room is never so nice as when prepared in plenty of daylight. Ventilation is also of great importance, especially in the scullery section. Nature usually covers the articles we eat with a protective skin or shell, and a number of them protect the most useful portion by their own outer leaves, which have to be removed; and I think you will all agree that plenty of ventilation is necessary in this department. I have found also that the question of the aspect of the kitchen is one which needs to be studied in regard to ventilation. For instance, a kitchen with a south aspect would in summer be uncomfortably hot; and it is very annoying to have to suggest alterations after the working has actually begun.

On the subject of the treatment of the floors and the walls, it is very necessary to offer some advice. The Birmingham Gas Department some little time ago were asked to advise and quote for the equipment and fitting-up of a new kitchen which it was proposed to include in some extensions. When the plans were examined it was found that the floor was intended to be of wood, the walls covered with plaster, and along the one clear wall windows were allowed for. This wall faced due south. These conditions were hardly suitable for an ideal kitchen; and as the architect is a gentleman of some standing in his profession, it was a matter of some delicacy to approach him with suggestions. After several interviews, however, the Department were successful in securing the following alterations: A concrete floor was put in covered with red tiles, a brickwork flue erected, and the walls covered with white glazed tiles. The window spaces were built up and lantern lights fixed in the roof to give the maximum amount of daylight. In the arrangement of the apparatus, let all the operations which are necessary have one aim—that is, that they all be a part of a continuous progress to the serving point. I have seen installations in which the apparatus has been jumbled up to such an extent that the kitchen staff have been caused an unnecessary amount of running about, resulting in confusion during the busy portion of the day.

It will at once be realized that, with a large amount of gas apparatus in use in a kitchen, removal of the products of combustion demands great consideration; and it is always a source of satisfaction when you are shown the proposed site of a canteen to find a brickwork flue already in existence, into which the products may be discharged. When this is not available, however, other methods have to be adopted; and I give some examples that have come under my notice, hoping that those who have tried other methods will give the meeting the opportunity of hearing about them later. The first method I will mention is that of taking an individual flue-pipe from each unit of the apparatus. This means a great amount of flue space being in use; and, if it is made of galvanized iron, will mean periodical renewals, as well as detracting from the appearance of the kitchen. This method also ignores the heat rising from the hot-plates of cooking stoves, and the steam from the various vessels in use.

The next method is to allow the products to gather into a hood (which should be large enough to cover the whole of the apparatus), conveying them by means of one or two main flues either into a chimney or directly outside the kitchen. Another method is to collect the products into a hood, as in the instance previously mentioned, and pull them out by means of a fan. This is a very satisfactory way, as it provides a definite course of travel for the products to take, and is not subject to interruption by down draughts or contrary winds. While on the subject of hoods, I should like to mention some of the types in use in Birmingham. Most of these are made of galvanized iron, and have a small gutter fixed at the lower edges to catch the condensation which accumulates, particularly when the apparatus is first lighted-up, and when steam is rising during the cooking operations. This gutter should never be omitted, as the extra cost of fixing it is more than compensated by the clean condition of the walls and the avoidance of constant dripping on to the apparatus. Another type is the glass hood. The frame-work is made up of tee and angle iron; the intervening panels being sheets of plate glass, reinforced with wire netting. Along the edge of this is fixed a copper gutter, which gives a good finish to it. One great advantage of this type of hood is that it does not exclude the light from the top of the apparatus—a point which will appeal to those who have to use it. It also allows for easy cleaning, the importance of which must not be overlooked.

The type of flue-pipe is also a question which is worth mentioning. I suppose all of you are convinced that the short life of galvanized iron pipe is very unsatisfactory. Black iron, painted and then stoved, is equally as good, and in many cases superior. Copper pipe is very desirable; but this is so expensive that unless you are making a show job it is out of the question. For some little time past we have been using flue-pipe made by the British Everite and Asbestolite Works, Ltd. So far it has answered very well, and when it has been in use a little longer we shall be in a position to form a definite opinion as to its merits. It is very light, can be cut easily, and can be joined by the use of sockets; the jointing material being ordinary cement and asbestos pulp.

No canteen is, of course, complete without a good supply of hot water, and also boiling water. This seems to me a branch where gas-heated apparatus can do the work most successfully. A circulating system should supply hot water to the sinks and to the vegetable boilers; and a choice can be made from the various makers of hot-water kettles and instantaneous hot-water heaters now available.

I think an idea of the amount of apparatus required for various numbers of people will probably be useful. I have tabulated the information. [See overleaf.]

With cooking apparatus in use so frequently as in the case of canteens, it is wise to see that wear and tear is looked after, so

Apparatus Required.

Number of Persons.	Single Cooking Stoves.	Double Cooking Stoves.	Treble Cooking Stoves.	Domestic Boilers.	Circulating Boilers.	Vegetable and Pudding Steamers.	Fish Fryer. Number of Pans.	Carving Table and Hot Closet.	Water Boiling Apparatus.
50	2	..	..	12 2-gallon	..	..	..	1 to 3 ft. long	..
100	1	1	..	12 3-gallon	40 1-gallon	1	1	1 ,, 4 ft. ,,	1
150	..	2	..	12 5-gallon	40 1-gallon	1	1	1 ,, 6 ft. ,,	1
200	1	2	..	12 3-gallon	40 2-gallon	1	2	1 ,, 6 ft. ,,	1
250 to 300	..	1	1	12 4-gallon	40 2-gallon	2	2	1 ,, 6 ft. ,, and additional hot closet	2

that there shall be no heavy bills for renewals and replacements, which, of course, would not be very acceptable. In this respect the maintenance section does useful work in keeping the apparatus up to concert pitch, and the cost of such work need not be prohibitive. In these days, when each section of an undertaking is expected to pay its way, it is perhaps too much to suggest that this work should be done free; but I am of the opinion that it should be so. However, the maintenance charges in Birmingham are not heavy—varying, of course, with the size of the installation.

One very important point in the successful running of a canteen is to see that as much information as possible is given to the staff who will be in charge. If they do not thoroughly understand the working and behaviour of all items installed, spend the time necessary for them to acquire this knowledge. One installation with which I had to do did not start with the success that I should have liked, owing to the fact that the cook engaged had always been used to coal-heated ranges, and somehow imagined that gas-heated appliances would mean a lot of trouble and were very dangerous, and also thought they needed very little time spent on them to keep them clean. After a number of demonstrations to her as to how to use various items, she improved, but did not give the results wanted. She was therefore replaced by a cook who had had previous experience with gas apparatus, and in a short time the whole thing went on quite merrily. You can imagine that I lose no opportunity to impart useful information after an event like the one I have just mentioned.

One matter on which I should like to hear something said is the question of the type of sink which is most suitable. You are all aware that at the present time the wooden sink is coming into use again—not, of course, on the old-fashioned lines, when it was merely a wooden trough, but in an organized system, which makes the necessary washing of crockery an easier task and enables a greater quantity to be dealt with in a much shorter time than the old method. These sinks are made of teak; and the arrangement of the water-flow through the various sections enables all the grease to collect in one given pocket, so that it can easily be dealt with. Opinions differ in most matters. Some prefer the wooden sink because the number of breakages is reduced, while others prefer the porcelain sink with wooden strips fitted to the edges, claiming that it is at these points that most breakages occur. Others again will have nothing but porcelain on account of its clean looking appearance. After careful observation on my part, my view is that the preparation sink should be of porcelain and the washing sink of wood.

A Few Hints.

One or two other points require careful watching from the gas point of view. First see that your meter is of a size to be well above the work required of it, so that if extensions take place they will be adequately served, and if there is a very heavy demand on some particular occasion, there will be no uneasiness on the question of supply. I need not emphasize the necessity of installing adequate supply pipes to the apparatus; but when so much is heard about supplying gas of a low calorific value, the district man has to remember he is responsible for the delivery of the required amount of gas, right up to the point of combustion, and must lay his plans accordingly.

For the benefit of those who have to deal with gas from which a fair amount of condensation accumulates, drain all your supplies back to the meter, if it be a wet one, and if a dry one let your syphon be of ample proportions, and close to the meter; so that the annoyance caused from this source may be as little as possible.

With regard to the construction of the apparatus used in canteens and other places, such as hotels, restaurants, clubs, &c., there are ways in which most of us would like to see alterations carried out; but on one point I think it is very necessary that an alteration should be made. I refer to the difficulty in cleaning out the crown chamber of internally-heated ovens of the double and treble cookers. When these have been in use for a year or two, it is no small matter to carry out this operation which, of course, adds to the expense of conducting the kitchen. I should like to see them constructed so that it could be accomplished from a removable plate just above the oven door; or the dividing plate between the oven and the crown chamber should be so fixed that it could be removed from the inside of the oven. It would also be an advantage if the tank portion of vegetable and pudding steamers could be removed with greater ease than at present.

The question of the rail taps, though not so difficult a matter as the other things I have mentioned, could, I think, be improved upon. When there are a large number of burners on the hot-plate, these taps must of necessity be very close together, and the taps often get damaged when taking them out. If they were fixed by means of a union joint, or a small flange held in position by two pins, I think it would be much easier to replace them.

Just a word as to the management of canteens. Most firms usually bear the cost of the installation, and then hand the management over to a committee or dining club; thus making it quite a democratic affair, as these bodies are usually elected annually. The charges made for meals are usually much lower than those for a similar meal obtained outside the works, and range from 10d. to 1s. 4d. for a meal consisting of meat, two vegetables, and sweets.

In conclusion I should like to take this opportunity of thanking those who have helped me in preparing this paper—Mr. R. J. Rogers for the use of the blue prints and the drawings which are here for your inspection, also Mr. A. Hill and Mr. Warby for their assistance.

DISCUSSION.

The CHAIRMAN proposed a hearty vote of thanks to Mr. Sturdy.

Mr. W LYCETT (Birmingham), who seconded the vote, pointed out that canteens could be divided into three sections: (1) First-class canteens; (2) works canteens; and (3) ordinary refreshment-house canteens. As to the works canteen, difficulty was often experienced owing to the inability of knowing precisely what was required.

Mr. W. COBB (Birmingham) said wood sinks were very serviceable; but owing to the tendency to rotting caused by the water, it would be of advantage to have the sinks tinned. As to the suggested use of a fan in the hood to take away the products of combustion, it would be preferable if steps were taken for the ventilation of the whole place.

Mr. W. E. CADWALLADER (Birmingham) pointed to the importance of the griller in a canteen, but said he could not recommend the double griller—one over the other—because the taps of the upper one became so hot that they could scarcely be used. It was essential that the crowns of the large cookers should be cleaned out at short periods. The introduction of a small door to admit of a scraper would be an advantage. Many cookers were allowed to get into a deplorable condition; and he had known instances where 25 p.ct. of the taps were slightly defective, owing to sheer neglect.

Mr. J. W. WOOD (Leeds University) said a large service counter was of great advantage.

Mr. A. KENDRICK (Birmingham) took the view that it might be advantageous to gas departments to maintain the apparatus without charge, provided there was a guaranteed gas consumption.

Mr. T. H POULSON (Stafford) gave a word of advice as to looking ahead, with a view to possible development, by putting in pipes and meters of sufficient capacity. Much disappointment was often caused owing to inadequate size of apparatus.

Mr. B. J. BELL (Hon. Secretary) pointed to the importance, in a commercial sense, to the gas industry of canteen equipment, and mentioned that the poor man's restaurant—"the fish-frier"—might be added.

Mr. STURDY, in reply, remarked that he had not specified apparatus, as each case had to be considered on its merits, depending on the class of canteen or restaurant to be fitted-up. Regarding the 12-gallon boilers, he thought, from the point of view of economy, it was better to split-up the load, especially where the number of diners varied from day to day. Wooden sinks, he agreed, were still to be found, though they were rarely installed to-day. On the question of maintenance of apparatus, he believed that regular attention was desirable—not sending a man from time to time as necessity arose.

Book Received.—An addition to the "Chemical Monographs" edited by Dr. A. C. Cumming is one on "The Chemistry of Combustion," by Dr. J. Newton Friend, Head of the Chemistry Department of the Municipal Technical School, Birmingham. The publishers are Messrs. Gurney and Jackson; and the net price is 4s. A review of the book will appear in due course.

Midland Association of Gas Engineers and Managers.—The annual general meeting of the Association will be held in the Grand Hotel, Birmingham, on Thursday, March 9, at 2 30. The annual report and accounts will be submitted; and the new President (Mr. W. H. Adams, of Bilston) will deliver his address. There is also to be a demonstration and explanation by Mr. Charles H. Webb, of Stourbridge, of a pipe-locating apparatus. A scheme for the formation of an emergency fund is to be considered.

North British Association of Gas Managers.—The Association will hold their spring meeting on Friday, April 7, at Kilmarnock, the home of the President, Mr. Charles Fairweather. Messrs. George Keillor (Greenock) and John Richmond (Penicuik) will read papers and open a discussion on "Gas Efficiencies," and Mr. T. W. Harper (Ayr) will read a paper on "Economies in Steam Raising." The members are being entertained at lunch by the Kilmarnock Corporation; and a visit will be paid in the afternoon to the Kilmarnock Gas and Electricity Stations.

SCOTTISH JUNIOR GAS ASSOCIATION.

(EASTERN DISTRICT.)

Visit to the Alloa Gas-Works.

The members of the Association paid a visit to the Alloa Gas-Works on Saturday, the 18th ult. There was a large attendance; and a profitable and enjoyable afternoon was spent. The party were received by Mr. J. W. Napier, the Engineer and Manager of the works, and his assistants.

At the inspection, chief interest was centred round the vertical retort installation, which has been in use for almost eight years, having been started to work in 1914. In 1912, ground of 4¼ acres in area was acquired, having a frontage to the River Forth, and thus providing water transport when necessary. The works have a railway siding connection from the North British Railway. The vertical retorts erected on the new site are of the "Wilson" type, and are 24 in number, of a nominal daily capacity of 750,000 c.ft., but capable with steaming of producing almost 1¼ million c.ft. The installation is complete with the usual hoppers for coal and coke equal to 48 hours' supply, a gravity bucket conveyor (Babcock and Wilcox), and hoist. With this type of setting there is no moving machinery; the charging and drawing being intermittent. Hydraulic power is used for opening the bottom doors of the retorts.

The retorts are brick built, of best "Glenboig" brand. In view of the length of time they have been in use, it was learned with interest that the expenditure for renewals of retorts had been exceedingly low—being £700 for a period of eight years. The retorts generally were stated to be in very good condition; and it was not yet possible to estimate the years they were likely to last out. One of the retorts was open for examination, and after seven years' actual use, with one letting-down, was in almost perfect condition.

Steam is admitted at the bottom of the retorts as high up as possible. The steam is superheated to 600° to 650° Fahr., by means of a separate superheater. The make of gas per ton is about 18,500 c.ft., of 400 to 410 B.Th.U.; and this quality of gas has been maintained for public supply for the past two years. In a flat-flame burner, the gas appears almost non-luminous.

A set of water-tube condensers attracted attention by reason of the position chosen in relation to the other plant. Additional condensing plant was needed; and instead of erecting it alongside the existing condensers, the new ones were connected-up to the foul main, in close proximity to the retorts. The reason for this was that it was sought to obtain a supply of hot water for the Lancashire boiler close by. The temperature of the gas entering the condenser is about 250° Fahr., and at the outlet about 130° Fahr. The overflow hot water from the condenser is taken to the boiler, its temperature being from 130° to 145° Fahr. The water supply to the condenser is regulated by the requirements of the boilers.

The exhausters, Livesey washer, brush-scrubber (Holmes), and purifiers are equal to a daily capacity of about a million c.ft. There is a well-equipped laboratory, with up-to-date testing apparatus, a chemist being permanently employed. There are compressors, electrically driven, to supply areas outside the burgh; and also a "Sturtevant" fan of a capacity equal to 100,000 c.ft. per hour, up to 15 in. pressure water-gauge.

The sulphate of ammonia plant is most complete. Neutral sulphate is made; the salt being sprayed in a centrifugal machine with ammoniated water made by condensation of ammonia gas from the still. The salt is dried on a simply constructed iron plate, internally heated with steam. Before bagging, the sulphate is put through a crusher driven by a small gas-engine. The sulphate is sold direct to farmers, and is bone-dry and ready for sowing by machine.

After the tour of inspection, the party were entertained at tea, which was presided over by Bailie Hunter, the Convener of the Gas Committee.

Bailie HUNTER said that, on behalf of the Town Council, he desired, as Convener of the Gas Committee, to bid the members welcome to Alloa. He was asked to state on behalf of his colleagues on the Council that it was their desire that every facility should be given to inspect the manufacturing plant and all information afforded as to methods of working and the results. The members would probably have observed the motto of the Burgh of Alloa, "In the Forefront," prominently placed on the vertical retort house. Some of them felt that the words were appropriate to their gas undertaking. They might modestly claim that for the long time of 25 years, during which there had been many upheavals and changes in the industrial world, the gas-works of Alloa had been maintained at a high level of efficiency. The one evidence of success in practical and financial handling of an industrial works was the price of its chief product. The price of gas to consumers in Alloa had been among the very lowest of any gas undertaking in the country. This result, maintained over many years, had not been arrived at by a policy of economy in the spending of money on new plant. Rather the reverse had been the case. He found, for example, that electrical retort-charging plant of the De Brouwer type was installed in 1905—the first of its kind in Scotland—and scrapped in 1914, when some other gas-works were putting in the plant. Similarly a telpher coke-handling plant, erected in 1909, was scrapped in 1914. Vertical retorts were started to work in May, 1914, at an early stage in the adoption of this type of retort. The members had inspected the plant, and had doubtless formed their own opinions and judgment. Whatever were the merits of the different systems of vertical retorts, he was not in a position to discuss—he was only aware of the results in the balance-sheet and the charges to consumers. In 1902, the year of the appointment of the present Manager, the capital account was £32,000, with the manufacture of gas at 88 millions. In 1921, the capital account stood at £38,000, with the manufacture of gas at 226 millions. The price in 1902 was 2s. 4d. per 1000 c.ft. In 1914, the average price was 2s. 2d.; in 1919, 2s. 6½d.; the price now, owing to circumstances resulting from the coal strike and the low price of residuals, was 3s. 3d. The output in Alloa was 207 million c.ft. for a population of 17,500. These data they would be able to compare with the figures for other towns. Since the works were started in 1829, only four individuals had occupied the managership—Mr. Napier, the present Manager, since 1902. Previous to that, Mr. Alex. Yuill (now of Dundee) held the position for 16 years, from 1886 to 1902; and Mr. George Boyd and Mr. Henry Young held the position for 25 and 32 years respectively.

Mr. W. A. DEARDEN (Vice-President), in the absence of the President, tendered the thanks of the Association to the Alloa Corporation and to Mr. Hunter and Mr. Napier for their splendid reception. The example of vertical retorts they had seen, particularly a retort which had been in use for seven years and was little the worse, bore out his own opinions of vertical retorts in general, and was a tribute in particular to the "Wilson" settings.

The members accorded a hearty vote of thanks to the Corporation, and to those who had done so much to make the visit a successful one.

Mr. J. W. NAPIER gave a helpful and particularly interesting discourse specially applicable to the Juniors. He reminded them of initiative, and recommended that they should not be prone to follow in grooves cut out for them—rather bring to bear their practical and theoretical knowledge on the matter in question and work out their own salvation. Quoting John Stuart Mill, he said it was good advice to "Think out the matter for yourself, but not necessary on lines different from other people." Looking back on the years of his life, Mr. Napier said it had been a tower of strength to him that he had tried to decide for himself; and it had proved a valuable asset that he had been able to conquer the influence of crowds and general opinion, and follow a single path. He urged the Juniors to keep this maxim ever before them. Referring to the gas-works at Alloa, he said in the first place he had been fortunate always in having as conveners councillors who were business men, and who gave him in every way all the assistance he had asked. It had been possible to keep the capital account at its present figure by installing efficient plant; but behind that the commercial policy had always been well studied. Capital having been spent, it was necessary to increase the turnover; and when he stated that the consumption of the prepayment customer averaged 33,000 c.ft. per head, he thought that was a good return. In 1905, they were among the first to introduce free cookers. They had been making 400 B.Th.U. gas now for two or three years; and complaints were unknown. In 1914, with horizontal retorts, they were making 9468 c.ft. per ton; in 1921, 17,780 c.ft. per ton, with verticals. He drew attention to the retort he had shown them that day, which had been in use for nearly seven years, or 2555 days, equal to a throughput of 9000 tons of coal. Judging from the state it is in now, it was likely to work at least another three years; and he had no compunction in saying that ten years would probably be a good average for the life of a retort. He said, in closing, that not only had he been able to keep the price of gas low, but, further, had been able to give £15,000 to the Electricity Department.

A hearty vote of thanks was accorded Mr. Napier for his address.

Mr. CAMPBELL (Dunfermline), and Mr. R. B. CHALMERS (of Messrs. R. & A. Main) also addressed the meeting. The former commented favourably on the low upkeep charges of vertical retorts, and said that in Dunfermline, where the verticals had been working for eighteen months, the expenses so far had been *nil*. Mr. Chalmers said he had heard low-grade gas described as "greased air." He thought it was immaterial whether the gas was of 400 or 500 B.Th.U. quality, so long as the quality was steady. Instruction to consumers on the care and the regulating of gas appliances was necessary; and he thought it was up to gas companies to educate consumers on these subjects. The "bad gas" complaint generally turned out to be dust in the burner or fires which had probably been cleaned by the consumer "externally" but not "internally." The electric lighting was very indifferent in his locality; and it had got so bad that he finally decided to instal his own gas plant. This had now been done; and his own house was now an "all-gas" house. The coke used was vertical retort coke; and he found this more suitable in every way than horizontal coke.

The meeting was then brought to a close by a vote of thanks to Mrs. Napier and the ladies who had looked after the wants of the members so well at the tea table.

"B.C.G.A." Southern District Conference.—It has been arranged to hold a British Commercial Gas Association conference in the Coliseum, Portland Terrace, Southampton, on Tuesday next, March 7. The President of the conference—Mr. J. C. Moberley, M.A. (the Chairman of the Southampton Gas Light and Coke Company)—will welcome the visitors at 11.45; and then there will be an inspection of the newly-organized distribution stores of the Southampton Gas Company, with an explanatory address by Mr. J. R. H. Jacobs, the General Manager and Secretary of the Company. Luncheon on the invitation of the Chairman and Directors of the Company will be followed by a public conference, at which there will be an opening address by the President, a statement by the Chairman of the Executive Committee (Mr. F. W. Goodenough) on the work and policy of the Association, and two discussions—on "The Hygiene of Gas," to be opened by Mr. Jacobs, and on "Gas in Relation to Modern Housing and Factory Requirements," to be opened by Mr. W. J. Sandeman, Distributing Engineer to the Croydon Gas Company. The following further dates have also been fixed for District Conferences in the near future: Manchester District (Lancashire Section), Blackburn, March 22; Manchester District (Yorkshire Section), Bradford, March 28; Midland District, Coventry, April 27.

SOME NOTES ON LABOUR ANALYSIS.

By A. BROADBENT, of the Gas Light and Coke Company.

[A Paper read before the London and Southern District Junior Gas Association, Feb. 24.]

The subject with which I wish to deal briefly this evening is one which is engaging the attention of many industrial concerns at the present time, and is one in which you who are responsible for the supervision of labour must of necessity be interested. However, with the limited time at my disposal, I can only touch upon the fringe of the subject; and this I will do in as concise a way as possible. By the term "Labour Analysis," which I use for simplicity, I mean the analysis of the day's work as recognized by Labour. In this case, the labour referred to is that engaged in the distribution department—*i.e.*, fitters of all grades.

The urgent necessity for analyzing the day's work has been brought about by the changed conditions of labour during the period of, and immediately following upon, the great war, which has brought in its wake, as you are all well-aware, an abnormally high cost of labour. With this high cost of labour is associated unfortunately a correspondingly high measure of waste; and, as one writer has well said, "Of all waste, the waste of labour is the worst." It will be my endeavour, therefore, with the kind permission of the Company I have the honour to serve, to give you an outline of something which has been done during the last couple of years, with a view to eliminating this waste of labour, and to give you some details of the work accomplished.

It was the task of those in charge of the work to establish whether the best results were being secured with a minimum waste of labour, time, personal energy, material, and money. With this end in view, it was necessary to devise means to ascertain how the day's work of the fitter was made up; and after much careful thought and consideration, what is known as a Fitter's Summary Card was devised. Without going into full details of its make-up, let me say that, by the use of this summary card, it has been possible to arrive at the following division of times of the fitters:—(1) Working. (2) Walking. (3) Yard. (4) Refreshment. I will explain these terms.

(1) *Working Time* comprises the time spent actually at work either in the workshop or on consumers' premises.

(2) *Walking Time* is that time which is occupied in walking from the yard to the first job and from one job to another, and back to the yard in the evening.

(3) *Yard Time* is that time which the fitter necessarily spends in the yard at the commencement of the day when he is receiving his instructions from the foreman and drawing material, &c., from the stores, and in the evening when reporting the result of his day's work to the foreman.

(4) *Refreshment Time*, as the name implies, is that time which is allowed each fitter for refreshment in the forenoon.

(The times referred to are reckoned to the nearest five minutes.)

These four sets of times* for the whole of the fitters attached to each depôt were plotted on a chart, so as to give a graphic presentation of the facts—the "peaks" and "valleys" showing up very plainly—and from a close study of the figures represented, it has been possible to make certain changes of material value and saving to the Company, and with advantage to the fitters. Briefly, I will enumerate some of the points which have been brought to light, and some of the steps taken to amend the practice in vogue so as to secure greater all-round efficiency.

On some districts, it was found that the "walking" time was particularly high, being in extreme cases 30 p.ct. Investigation proved that this was due, in some measure, to local conditions—such as: (*a*) The position of the district, involving the climbing of a long gradient to it from the depôt. (You will readily see how this would affect the time occupied if the fitter had a truck to push or heavy materials to carry.) (*b*) The district on which the fitters were engaged being a long distance from the depôt. In these latter cases, a considerably lower percentage was achieved either by establishing sub-depôts or by transferring the operation of these districts to other depôts nearer at hand, and (or) in paying the fares of fitters where a frequent service of trams or motor buses was available.

The percentage of "yard" time was found to vary considerably; and those cases which greatly exceeded the average were made the subject of special inquiry. This inquiry brought to light minor peculiarities, and also elicited defects in organization which the management was able to rectify. Among these defects might be mentioned insufficient counter room in, and narrow entrances to, the stores, which caused serious congestion at times. To get over this difficulty, where it was not possible to extend, a system whereby fitters' requirements of material, &c., could be prepared during the day, was introduced.

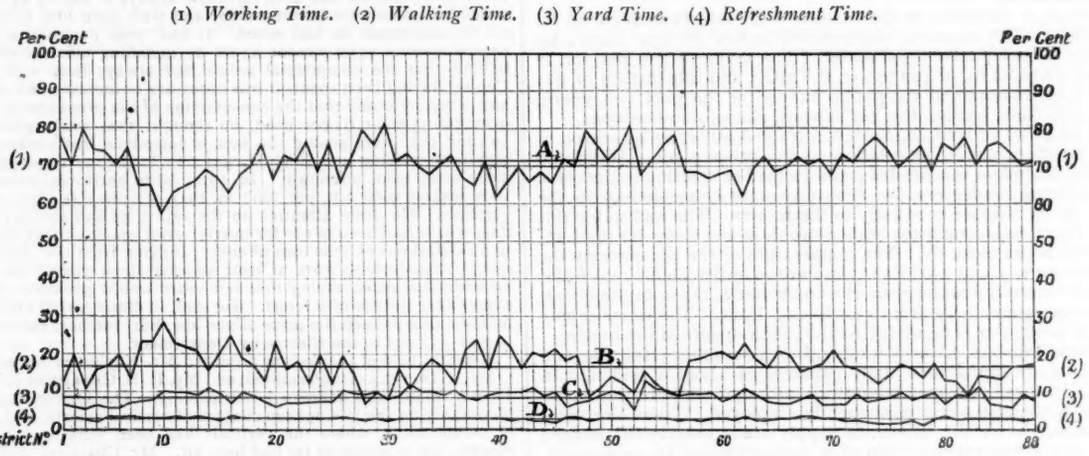
Since every fitter is allowed fifteen minutes for refreshments, the percentage of "refreshment" time almost invariably approached the maximum—a natural sequence, as you will agree.

The four-way charts to which I have referred are prepared periodically, and comparison is made one with another. Of course, it is not necessary for me to tell you that the charts for each district must of necessity vary—sometimes considerably—by reason of the difference in the make-up of the district; but I can say it is now possible to determine those districts which resemble each other in many respects. Moreover, it has now become possible to draw reliable comparisons.

To illustrate the progress which has been made since the work was taken in hand, I think I cannot do better than give you the average figures for all districts of the first analysis, and of two subsequent ones of recent date.

ANALYSIS OF FITTERS' TIME—47-HOUR WEEK.

(1) *Working Time.* (2) *Walking Time.* (3) *Yard Time.* (4) *Refreshment Time.*



A.—*Average* 71·6 *p.ct.* = 33·7 *hours.* *B.*—*Average* 16·9 *p.ct.* = 7·9 *hours.* *C.*—*Average* 8·6 *p.ct.* = 4 *hours.* *D.*—*Average* 2·9 *p.ct.* = 1·4 *hours.*

	(1) P.Ct.		(2) P.Ct.		(3) P.Ct.
Working time	67·5	..	67·5	..	71·6
Walking ,,	19·0	..	20·5	..	16·9
Yard ,,	11·1	..	9·3	..	8·6
Refreshment time	2·4	..	2·7	..	2·9
	100·0	..	100·0	..	100·0

To illustrate some of the extreme cases, I might mention the following:

Working time increased from 57 p.ct. to 74 p.ct.
Walking ,, reduced ,, 30 ,, ,, 12 ,,
,, ,, ,, ,, 24 ,, ,, 16 ,,
Yard ,, ,, ,, 16 ,, ,, 8 ,,
,, ,, ,, ,, 13 ,, ,, 7 ,,

The analysis I have briefly outlined does not stop where I have left it, but has since been extended in the following manner. The "working" time has been divided so as to show separately "revenue" or chargeable work and "district" or non-chargeable work. Further than this has been ascertained the average working time spent on each job ("revenue" or "district"). With regard to the former, you will at once realize that the job times must necessarily vary considerably, both from time to time and on districts which differ widely in character. With the latter, however—"district" or non-chargeable jobs—the average working time spent per job should not differ seriously. As I have said previously, there are circumstances peculiar to certain districts which, if unknown, might lead one to a wrong deduction; but, speaking generally in averages, such as obtain in the majority of districts under consideration in my remarks, it is reasonable to say that the average time per job should be nearly the same.

It will occur to you, no doubt, that with a lower "yard" time, a higher "working" time should result. This is not always the case, as if every fitter is engaged on "district" work—*i.e.*, remedy-

* Reduced to percentages of the period comprising a week's work.

ing defects, &c.—it is possible for the "walking" time to be materially increased, because of more jobs being done in a day. In the general averages I have quoted, No. 2, for instance, is a case where the number of "district" jobs carried out was considerably above the average, and the "walking" time, in consequence, crept up to over 20 p.ct. No. 3 is a case of an extreme in the opposite direction, where the proportion of "revenue" work carried out was considerably higher than "district" work, with the result that the "working" time increased, while the "walking" time decreased.

DISCUSSION.

The CHAIRMAN (Mr. D C. Cross, of Lea Bridge) said the paper really touched upon one department; but it would be realized that one could adapt it to any part of an undertaking. It was as important to the works man as it was to the distribution side. Labour analysis should be introduced in practically every department of a company, in order to increase efficiency. Especially on the works, the great point of labour saving was to get the foremen to appreciate the enormous waste of labour that was possible in the handling of men. This was well recognized. They all knew that one foreman would do work with three men for which another would require four. There was thus a waste which an analysis would reveal. Then by means of such an analysis one could focus where the money was being spent, and so have an opportunity of reducing working expenses. The system was admirable; but there seemed to be a personal element creeping in. It appeared to rely a good deal upon what a man put down on the card. The refreshment line was extraordinarily straight. He wondered what check there was on these figures. In any case, however, there was no doubt that these analyses were very valuable, and that they did tend to increase efficiency.

Mr. J. R. GALE (North Middlesex Gas Company) asked whether there was any check as to the time expended at an individual consumer's house. Did the consumer sign the card showing the time the man arrived, and when he went away? Again, were any of the men on piece-work, or were they on day-work? It seemed to him that the most efficient way of checking was to have a foreman going round to see that the man was doing his work properly, rather than to rely upon the man's filling in his card himself.

Mr. W. L. WESTBROOK (North Middlesex Gas Company) inquired whether the Company had any record of the saving secured by adopting this system, and what was the cost of keeping the check.

Mr. F. AINSWORTH (Ilford Gas Company) said there was no doubt that Mr. Broadbent had not had a very simple proposition to deal with. They all knew that on the district the problem was a difficult one. He remembered when men made out their time weekly; and one could quite understand what this meant. He could recall when there were no such things as time-sheets; and one could realize what happened then. It appeared to him that on the district what was wanted was that those who had to look after the men should have the means of getting to the spot quickly, without having regular times, so as to see for themselves that the men were doing the work. Men who were trustworthy were only too pleased that they should be supervised in this way. He referred to differences in meter-reading work, and pointed out how much this depended upon the situation of the premises and the position of the meters.

Mr. S. A. CARPENTER (North Middlesex Gas Company) also asked whether they had been able to trace any saving due to this system. If they were able to get more work done for the same wages, this was proof of the usefulness of the system.

Mr. D. J. WINSLOW (Lea Bridge Gas Company) said it seemed to him that the chief value of the system was the moral atmosphere which it had a tendency to create. It was human nature to get slack at times; but if a man knew that this was up-against him, he would be likely to do his best. Had the author any comparison of the time taken on a job and the actual cost of the job in revenue cases?

Mr. F. J. PEARCE (North Middlesex Gas Company) thought they all appreciated that a system which appeared on the face of it somewhat complicated might be necessary to check the large number of employees engaged, more especially on the district side of a big undertaking such as the Gas Light and Coke Company. The details from this point of view were very interesting; and to a certain extent, of course, they were just as necessary on the works, though he hardly thought that on an average sized works a system of the sort would show the immense saving that it did on the district side. The question of supervision had been raised in the discussion; and there was no doubt that this played a very important part.

Mr. BROADBENT said there was no denying the fact that, as Mr. Cross had pointed out, the human element did come in a good deal; but there was such a system of cross-checking the ticket issued by the Company for the job against the summary card, that the risk was not so great as might at first sight appear. As to checking on the district, the fitter did not know at what time the foreman might be going to a particular job. The foreman did get about the district to various jobs. He agreed with Mr. Ainsworth that, in order to secure the most efficient supervision of this character, it was necessary that the foreman should have means other than walking of getting about the district. To the question of whether they had a check by the consumer, the answer was no. The only check was in the foreman going round, and in his inspection of the summary card which the fitter made out for all his jobs. He arrived at one job at a certain time, and left at a certain time; and he booked this up when he did the job. It was all day-work; there was no piece-work whatever. The cost of keeping this check was part and parcel of a costing system. The detail figures had to be got out for other purposes. There was no doubt that the system had effected a very large saving. As to Mr. Ainsworth's reference to meter reading, each district, no matter whether it was in connection with meter reading or other jobs, had to be treated separately. It was necessary thoroughly to understand the peculiarities of a district. The average time on one district would not be suitable for comparison with another, owing to the differences in distances involved. As to costing revenue jobs, this work was now in hand. That was to say, they were taking the charges made to the consumer for revenue jobs, and comparing these charges with the actual cost of doing the job.

THE APPLICATION OF TOWN GAS FOR BULK HOT WATER SUPPLY, CENTRAL HEATING, AND STEAM RAISING PURPOSES.

By SAMUEL B. CHANDLER, of the South Suburban Gas Company.

[A Paper read before the London and Southern District Junior Gas Association, Feb. 24.]

It is a truism to say that the use of gas for cooking and gas-fire purposes is now well established; the major part of the public appreciating the benefits derived from gaseous fuel for these special purposes. Popularity is secured, and with a continuation of effort and maintenance of good service there is no doubt as to future extension of gas output for these two particular services. We may, without being unduly optimistic, consider this phase as *un fait accompli*, or as our line of least resistance.

HOT WATER SUPPLY.

Hot water supply for domestic use is most important; and provided this aspect of gas service receives the careful attention it deserves on the part of those in the distribution and public service departments of our industry, there is no doubt that considerable increase in output will accrue from this form of apparatus as time goes on. This use is as yet by no means universal, and may be regarded as our second line of resistance to be overcome and popularized.

INDUSTRIAL USES.

The third phase, and one of the more difficult ones in coal-gas supply, lies in its application in spheres where coke or solid fuel is now used, and other than for power and furnace work. The advantages and efficiency of town gas for industrial purposes are becoming more and more appreciated. Examples constantly come under notice which carry out their functions well, and both from a thermal and utilitarian standpoint have fully justified their introduction and use.

SPECIAL DEPARTMENTS.

Great and unflagging attention is focussed by progressive minds upon this part of our industry; and in this connection we must express our appreciation of the work of undertakings such as the Gas Light and Coke Company and the South Metropolitan Gas Company, both of which have instituted special departments to deal with these matters—the latter Company designing and evolving burners, furnaces, and other apparatus, based upon special requirements and applications of consumers, and thereby making certain that each case is served in the best possible way and the most beneficial results secured to the user by the adoption of gas as a fuel. This is real service to the industry, and a most necessary one in convincing manufacturers and others as to the claim made that gaseous energy, properly and scientifically applied, has advantages over other forms of fuel for most of the heating processes in general use.

GENERAL USES.

These uses of gases—*i.e.*, for cooking, heating, domestic hot-water supply, power, furnace, and industrial purposes—are well established, and, apart from cost of gas, which naturally influences every case, need mainly pushfulness and application on the part of the industry to extend further. In regarding these potentialities, one is encouraged in contemplating the future of gas output in these directions, especially when, as we all hope and expect, price per therm descends to something like a reasonable figure, so as to permit of large quantities being taken. This, for present purposes, represents, as I have said, our third phase.

BULK SUPPLY.

Considering, now, our fourth aspect—namely, gas for use in wholesale quantities for bulk water-heating and steam-raising purposes—we find it one that must be approached carefully and with considerable technical investigation. The matter may, with advantage, be divided into three parts:

(1) Water heating in bulk.
(2) Centrally heated systems.
(3) Steam raising.

Taking (1) and (2). Among the special points to be considered in contemplating any case must be time-element, duration of use, special circumstances, and fuel cost, which, together with the proved advantages—viz., absence of stoking, minimum of labour, absolute control, certainty of results, and over-all thermal efficiency—make our review complete. Fuel cost, although possibly higher than that of solid fuel, is in very many instances more than counterbalanced by the convenience, adaptability, and general service experienced with gas-fired systems; and in presenting a scheme it is as well to point out these factors, which certainly accrue where gas is adopted.

COSTS.

Relative costs of gaseous, liquid, and solid fuels vary in almost every instance; and I do not intend to put forward detailed comparisons, as these are governed by local and other factors. As a matter of interest, however, and to illustrate my line of thought, I cite an example where gas is rendering excellent service by

providing hot water in bulk, economically and satisfactorily, and where solid fuel was originally intended to do the work.

Example.—This concerns a large athletic pavilion erected recently, upon the most modern lines, in Kent; the hot-water service being required for two large sunk plunge-baths, forty basins, two or three baths, and five sinks. The opportunity gas had for heating the 1400 gallons storage was considerably assisted by the special requirements of the consumers. The system is in use about twice a week; and on these occasions practically the whole bulk is required. In addition, the points made which secured the load were based mainly on these special circumstances, absence of labour, stoking and preparation, cleanliness in use, and certainty of results; the anticipatory figures given for time and temperature being maintained in practical use. The coke-store is used to house one battery of boilers and the meters. The over-all thermal efficiency is very good indeed, and the installation well worth the notice of those engaged upon distribution. A full description appeared in the "Gas Journal" for April 13, 1921 (p. 98), and will be of interest as an example of gas applied on a large scale.

Test.—A test taken under working conditions gave a thermal efficiency of 76·8 p.ct. and gas consumption 2·5 c.ft. per gallon raised from 48° Fahr. to an average of 144° Fahr.; the time taken being three hours from lighting-up. It should be noted that the temperature taken is that of the water at the taps—some distance from the storage tanks—and is after allowing for losses in heating, circulating, storing, and delivering. This result is encouraging, and for short hour and special requirements, therefore, gaseous *versus* solid fuel should often result in the adoption of the former upon the lines indicated.

Central Heating.

Centrally heated radiator systems again present certain problems, and for large buildings where this form of heating is required over long periods and every day, the time is not ripe, generally speaking, for gas. He would be an unwise man who proposed its use in these circumstances—indeed, the opportunity is a remote one. Price of fuel is here a most important factor, and until we get down to pre-war, and possibly lower, prices, we cannot anticipate fulfilling all requirements of this nature. Low price per therm and a combination of high efficiency boiler with automatic regulation might contribute towards making costs more comparable. For small installations, however, in private residences, where two or three heating elements are involved to amplify the general warming, gas has an opportunity; and in such instances a gas-heated system, with its attendant advantages, is an economy, and may be depended upon to produce predetermined results unfailingly and without labour. Progress is certainly being made in this direction, and quite a number of installations exist where small radiator systems are in use for the production of low-temperature convection heating—sometimes as an aid to gas-fires—thereby providing a combination of radiation and convection which gives pleasant warming conditions. It is understood, of course, the heating is of a low-temperature order, controlled by a thermostat; and the unpleasant conditions, often found with coke-heated units of high temperature, are thus avoided.

Example.—In one case which has come under notice, a gas-boiler (80 c.ft. capacity) has been connected to six radiators fitted in various rooms, having a total radiating capacity (including exposed pipe work) of 213 sq. ft. Usually three heating elements only are in use at one time, each under separate control; and the occupier's requirements demand about six hours' use per day. Careful check is kept on consumption; and readings over a period of 69 days (November to January) show an average of 290 c.ft. (1·6 therms) per day, which includes gas occasionally used through the fires. The radiator system is in use more often than the gas-fires; these only being put into operation in very cold weather. Many other cases exist, notably the installations recently made at the Automobile Association and premises at Old Bond Street (where 25 radiators are served by five gas-boilers). These examples encourage one to regard this special use as one which, closely followed up, would yield some measure of success.

Steam Raising.

My last point marks, perhaps, the latest application of coal gas to industry, and has potentialities which, if properly exploited, will do much to aid gas sales. The subject of steam raising is worthy of a special paper; and I hoped to have been able to present test results of one or two installations recently made. Delay has arisen, however, and I can only now introduce the subject, and make a few general remarks thereon.

Considerations.

In contemplating steam raising by town gas, one is at once checked by "fuel cost;" and certainly at the moment gas can only be considered in very few instances, and then only when, as in central heating, the character of the work involved permits. For small laundries, experimental work, and in confined spaces where solid fuel storage is not possible, and where requirements are intermittent, gas has a claim to admission, and fuel cost then becomes, perhaps, an item of minor importance. The recent appearance of a steam-boiler employing low-pressure gas in a novel manner has led to the installing of a number of units which are giving (to my personal knowledge in two instances) a good account of themselves and performing satisfactory service. Steam-raising by gas is a form of output which has favourable features and one to which we should look to help our gas sales in the future. It represents a new form of application yet in the very early stages, and must eventually become the subject of serious attention.

Conclusion.

It seems desirable that further information should be available and the subject would form excellent matter upon which a paper by a member of the Junior Association might be written, as I feel convinced it has great possibilities.

Much more might be said upon the various points raised, and although full agreement with the views expressed may not be secured, discussion upon them will advance our knowledge and must certainly be of a helpful character.

DISCUSSION.

The Chairman (Mr. D. C. Cross, of Lea Bridge) remarked that the paper was a masterly summary of the fields that were open to the distribution department for concentrating to secure an increase in gas sales. It was very cheerful, and very optimistic. He had noticed in a recent issue of the "Gas Journal" a short article headed "Admittanitis," in which was reproduced the argument of an American that gas people did not boost gas sufficiently, and were admitting that the fields of its utility were gradually falling away. Mr. Chandler had pointed out that this was not so, and that there still remained other fields to tackle. One trouble they were up-against in trying to displace coke was that coke had been going down rapidly in price, whereas gas had not descended at the same rate. He believed that coke had gone down 30 p.ct. within the last six months; while he had not heard of the cost of gas anywhere near him coming down more than about 14 p.ct. But, as had been pointed out, when gas was more nearly approaching pre-war prices, they would be better able to compete with solid fuel. The examples given by the author were very instructive. He hoped the members would concentrate on these lines, and try to get into the new fields that the author had suggested.

Mr. F. S. Larkin (Gas Light and Coke Company) inquired of the author whether the figure he gave for efficiency was net or gross. Sometimes claims were made that hot-water apparatus would give a bath at a certain temperature—the figure stated being at the outlet of the apparatus, neglecting the fact that, in the case of a cast-iron bath, an allowance should be made altogether of at least 20 to 25 p.ct. drop in temperature. He had lately come across several instances of very misleading figures in this respect. Did the author consider the figure he gave to be the ultimate useful figure for the water as it was used?

Mr. H. W. Kerridge (Croydon) said the paper was very opportune; for he thought all would agree that they were passing through a very critical time. They must take care to instal gas-boilers, &c., in an absolutely perfect manner. If they could not put in a gas water-heater to give the very best results, it was better to leave the matter alone altogether. The efficiency quoted by the author was very good; and he would like to know the time of year at which the test was made. In connection with steam raising, there was a very rosy future before them. Coke, of course, was going to be a strong competitor; but if they put in their appliances to give the very best results, there was no need whatever to fear for gas for water heating. It could be most economical. Once the appliances were properly installed, they would give continuous good service.

Mr. D. J. Winslow (Lea Bridge Gas Company) thought the paper was very encouraging; and it also emphasized the work that the distribution man should be able to accomplish. The paper gave them several instances in which gas had been put in for comparatively large installations. They all knew that gas could not be beaten for the smaller kinds of business; but when it came to the larger uses, then the price of gas entered seriously into the matter. The gas installation at the athletic pavilion referred to by Mr. Chandler was a large one; but it was only in use two days a week. They should be very careful in advising consumers whether to put in gas or coke apparatus. He had in mind a big convalescent home, where they were anxious to have a gas-boiler. There were several baths and wash-hand basins served by a very efficient coke-boiler; and when his advice was sought, he told them they should keep the coke-boiler. He should mention that there they had sufficient labour to keep the boiler stoked. Mr. Chandler had selected places for which gas was very suitable. When it came to bulk heating in the ordinary way, the cost of gas might be a drawback; and it was for the distribution man to know when and where to advise the installation of gas, and when and where not to.

Mr. W. E. Brown (Gas Light and Coke Company) asked the author whether he had had any experience of gas-boilers for raising steam for cooking apparatus. With regard to coke, there was one point, he thought, that was not given quite so much attention as perhaps it might be. This was the cost of stoking, when somebody had to be paid to do the work. Then there was the often very valuable space taken up in storing coke. In the City and West End, even basements were worth a considerable sum of money for letting purposes.

Mr. W. L. Westbrook (North Middlesex Gas Company) asked, in regard to the hot-water installation, on what basis the author proceeded. How many cubic feet per gallon were allowed? Also, was it a hard-water district; and what arrangements had been made, and at what periods, for maintenance?

Mr. G. H. Lloyd (Gas Light and Coke Company) said Mr. Chandler had introduced a big question, about which they would all like to hear more. In this connection, it seemed to him that figures of installations that had been put in would be very useful indeed, if only companies would circulate them for private information. Figures of this kind, whether satisfactory or not, would be of the greatest assistance to the staffs. As to the use of gas for water heating, he was rather optimistic; and he thought they need not worry too much over coke. No doubt, in the ordinary way for big installations coke was the thing; but there were many places where gas-boilers could be successfully installed. The work of putting water-heating appliances into places called for some little thought; and it was by financially recompensing their staff for putting installations in that companies were going to get the best results. He had suggested this before; and it was argued

that if they paid a man for putting hot water in, he might instal it where it was not suitable. Seeing, however, that the man would have the trouble of the thing afterwards, he did not think there would be any danger of this.

Mr. CHANDLER said the speakers appeared to be in agreement with him, at any rate on most points. The question of price was, of course, a very important one; but as coke came down, no doubt gas would do the same. He had not in any way suggested that gas was going to displace coke altogether. His point was that gas would have perhaps a better opportunity for meeting special demands in the future than it had had in the past. In the correct fitting of hot-water appliances lay the success or otherwise of the system. The test about which Mr. Kerridge had asked was taken in February; and the temperature of the water was 48° Fahr. Very careful advice must be given on the subject of installing gas water-heating apparatus; and it certainly paid undertakings to advise honestly. If an element of doubt existed in one's mind as to the wisdom or otherwise of making the installation, then the consumer should be told the exact position. In reply to Mr. Larkin, the gross value was taken; and with regard to the temperature of the water, this was taken at the tap. It would not have been much use taking it in the bath itself, because obviously the water was of too high a temperature to use alone, and so cold water was flowing in at the same time. He thought the temperature of the large plunge-bath was between 98° and 100°. He had had no experience of the use of steam for cooking purposes; but he understood the system worked quite well. For these appliances he believed about 10 lbs. of steam was the usual pressure. Of course, during the war they heard a good deal about the steam cooker, and quite a number were put in. He could not tell Mr. Westbrook the hardness of the water in the district where the pavilion was situated; but it was not very hard. Of course, these boilers were provided with thermostats; and the temperature of the water never got above 150°. The thermostats usually operated at about 140°. Maintenance was a most important matter, not only in connection with gas appliances of the nature they had been discussing. Everything should be looked after properly; and in this case two visits per annum were being paid by the makers of the boilers themselves. On their first visit nothing but a little cleaning was done. The maintenance would be very low. Reference had been made in the discussion to the usage of the installation being only twice a week. This special usage point was one of the most important features in arguing for gas. As to the point raised by Mr. Lloyd about undertakings circulating figures, it was a very good idea indeed. What he had been saying that night would bring home to those who did not already appreciate it the wide variety of subjects which it was necessary for a distribution man to-day to know. No sooner did he assimilate all the ideas of (say) hot water supply than along came something else in the way of steam raising; and so things went on. In reply to Mr. Westbrook, eight boilers with a consumption of 640 c.ft. of gas were attached to the 600-gallon cylinder. This meant about 700 gallons of water altogether including the boilers and circulating pipes. The pipes had, of course, been well lagged. There was no exposed pipe-work, and each pipe was a little hot-water tank. The consumption was therefore practically 1 c.ft. per gallon.

GAS FIRES AND THEIR VENTILATION, WITH SPECIAL REFERENCE TO CAVITY FLUES.

By W. L. WESTBROOK, of the North Middlesex Gas Company.

[**A Paper read before the London and Southern District Junior Gas Association, Feb. 24.**]

During the recent visit of our Association to the showrooms of the Davis Gas Stove Company, an item of considerable interest was the "Nautilus" gas-fire flue, the details and construction of which were explained by Major Wheeler. The flue is in itself striking evidence of the remarkable progress of the gas-fire, and a solid contribution towards the ideal of "all-gas" houses.

From conversations I have had with architects and builders, however, I find, generally speaking, they are rather reluctant to "burn their boats" as far as the abolition of the coal-fire is concerned. They consider it safer, from their point of view, to build the old type of chimney, which will serve for either solid or gaseous fuel. In my opinion, it will pay the gas industry to go slowly in the matter of special flues for gas-fires; and the solid British conservatism of the average builder will be helpful in the long run, as it will enable us to find out errors before serious harm is done to the progress of gaseous heating.

Several builders in my Company's area have been constructing flues in the cavity space of exterior walls, and carrying them up a matter of 6 ft. or so, terminating with a ventilating brick; these flues make excellent fresh air inlets when the gas-fire is not burning; but it is a stiff task for the gas-fire to reverse the air current. No doubt the fire would do it easily enough in summer time, but on a typical November day it is a different proposition. A gas-fire fitted to such a flue is not good business at all. It is no good boasting of the hygienic efficiency of the modern gas-fire if we are to tolerate defective ventilation.

In some cases I have tested cavity flues where it has taken five to ten minutes before the fire could reverse the down draught and set-up a satisfactory ventilating action; in other cases, although the flues were ventilating to some extent, a considerable proportion of the products of combustion were eddying back during the whole time the fires were in use. In the latter instances, the fires were fitted in angles, and the brickwork surrounds built out to accommodate the width of the fires, with the result that immediately above the fires there were considerable chambers with a double set-back in the brickwork leading to the cavity flues, which were of inadequate area and terminated at the ceiling level in ordinary ventilating gratings. The down draught on these flues were very bad before the fires were lighted; and although the waste gases were issuing fairly freely from the gratings into the open air, as previously stated, a considerable proportion was eddying back from the chambers into the apartments.

The fact of flues being constructed in the cavities of exterior walls has a chilling effect on the air within them, and naturally encourages down draught, in addition to which the grating terminals are often exposed to considerable direct wind pressure, the downward force of which, in a flue carried to the top of the house, would be considerably reduced by friction; whereas in a short flue the down current meets the hot waste gases which are trying to ascend from the fire with such force as to overpower them and force them back under the canopy of the fire into the apartment. On one important estate where special gas-flues have been constructed in the cavity spaces, the flues have been extended to terminate in the roof space, and the result has been on the whole very satisfactory. While a bad down draught from a roof space is sometimes experienced, I consider it generally more satisfactory to terminate a flue there than to discharge directly into the open air, always provided a properly constructed flue is not available. Care must, however, be taken to ensure that the roof is of adequate area, and not sealed by close boarding or felt lined.

I mentioned above that the result of terminating the flues in the roof space was, on the whole, satisfactory, the exception being in a house with a felt or rubberoid lined roof. In this house, which was an "all-gas" one, the installation comprised a complete hot-water apparatus (builders set), gas-cooker, copper, and gas-fires, all ventilating into the roof as stated above. The installation was tested on completion and passed as satisfactory. Subsequently, a complaint was received from the consumer that the hot-water apparatus was not satisfactory. On investigation, this proved due to bad down draught which caused partial smothering out of the flames, despite the fact that the boiler was provided with an anti-down-blow device. It was also found that the whole of the products of combustion from the hall fire were driven back by down draught. Further investigation by the Inspector revealed the presence of a strong down current of air from the roof directly he removed the trap-door; and a further test of the boiler and fire showed the up draught to be quite satisfactory so long as the trap-door remained unsealed. The builders were at once communicated with, and advised to fix a ventilating pipe in the roof with a revolving extractor head. The Inspector's theory, which is quite feasible, was that the sealed roof, being exposed to the hot sun (the weather was extremely warm at the time), caused a considerable expansion of the air in the roof space; the resultant pressure finding relief *viâ* the gas-flues. The ventilating shaft advised has not yet been fitted by the builders, who have cut away the rubberoid roof lining in several places. The installation is still under observation, and the ventilation of the appliances was satisfactory when tested recently. It will be interesting to know if the trouble recurs under hot-weather conditions.

For some years past we have been fixing self-contained gas-fires in positions requiring considerable lengths of flue-pipe. In preference to fixing gas-steam radiators or flueless stoves, our experience is that the ventilated fire, with its radiant heat, is much more satisfactory than convectors—indeed, the combination of radiant heat from the fire and convected heat from the flue-pipe seems to me an ideal system, and greatly increases the efficiency of the gas-fire as a heating unit. If the appearance of the galvanized flue is an objection, this can be easily overcome by casing it in with asbestos or uralite; the convected heat from the flue being recovered through suitable ventilating openings.

We have recently fitted several huts with gas-fires in this manner, including a bungalow and our co-partners' club room; surrounds and overmantels being fitted, with art-metal backing for the fires, and chimney breasts constructed of uralite, covering the flues, which were carried straight up through the roof or discharged under the eaves. Fires, with or without surrounds, have also been fitted in sale shops, toilet saloons, offices, and also in small bedrooms without chimneys; the fires being fitted in an angle of the room and the flues carried into the roof space—it being simple to conceal the flue-pipe, when fitted in an angle, with a strip of uralite. One fire which was fitted in a well-known contractor's office has been dealt with by the contractor in a somewhat novel manner; the accidental result being that the radiant heat of the fire is supplemented by a steady current of warm air (convected heat) from the back of the fire and flue-pipe. This fire is fitted in the partition wall dividing the contractor's private office from the general office; the flue-pipe being carried through the wall about 2 ft. above the fire, rising in the general office, and up through the roof. The flue elbow and short length of flue in the private office were encased in a surround made of floor boarding, panelled to give relief, and a mantelshelf fitted. The contractor found, on lighting the fire, that the mantelshelf became very hot; and fearing it would take fire, he cut away a large portion of the shelf, leaving a bare frame only, and fitted perforated zinc over the opening, thus augmenting the heat afforded by the fire as stated above. But of this result he was blissfully unaware until complimented on the arrangement.

This fire gives excellent results. In addition to keeping the private office comfortably warm, it also delivers a considerable amount of convected heat into the general office, which is also heated by a gas-fire, connected to a cavity flue; the old chimney

breast having been pulled down by the contractor to improve the appearance of this office and provide more room.

The testing of gas-fires after installation to ensure correct adjustment and efficient ventilation is of vital importance, and the same remark, of course, applies to other gas apparatus. A great deal more might be said on this important question, but not under a ten minutes' limit. I hope, however, that the subject matter will give rise to a full and interesting discussion.

DISCUSSION.

The Chairman (Mr. D. C. Cross, of Lea Bridge) said the great advance which had taken place in the last few years in gas-fire construction would be quickly nullified by bad ventilation. This down-draught problem was not properly appreciated by the ordinary builder and contractor; and distribution staffs should be fully alive to the great danger thus created. They should make it their aim to educate the people on their district to the danger, and to try by their advice to obviate faulty ventilation. It appeared that the 6-ft. flues to which the author had referred were really asking for down draught. What specially appealed to him was the last part of the paper, where Mr. Westbrook told them about the convected heat which was saved from the flue-pipe. Now in these days, when they were trying to save all the heat they could, it seemed that here was an opportunity to save, and so conserve the efficiency of the heating apparatus.

Mr. H. W. Kerridge (Croydon), relating troubles that he himself had encountered in connection with ventilation, declared that the author had his whole-hearted sympathy. Cavity flues were hopeless, especially for water-heaters. As to up draughts and down draughts, he sometimes wished they could make the atmosphere visible, so as to see the "capers it was cutting."

Mr. W. E. Brown (Gas Light and Coke Company) said that when they considered what architects and builders had done for ordinary fires, they could not be surprised if flues for gas-fires did not pull the right way. With regard to flues terminating in the roof space, had the author been up-against any trouble with condensation?

Mr. D. J. Winslow (Lea Bridge Gas Company) suggested that perhaps the author was confusing what he had found in his district with the "Nautilus" flue. He was sorry to think that builders had adopted such a plan as was outlined in the paper. The whole question of ventilation needed careful attention. In many new houses there was provision for flues, but none for fresh-air inlets. It was impossible to get air out of a room unless it was allowed to come in. He could not see any good whatever in ventilating under the roof, except in the case of geysers; and even then one had considerable down draughts. In the special case of the fire referred to by Mr. Westbrook, was he making any provision for possible blackening of the wall or ceiling immediately around the pipe?

Mr. G. H. Lloyd (Gas Light and Coke Company) referred to the case of a geyser, where the flue had been taken right outside to the open air; and there was a contrivance outside—a box flue—which absolutely prevented a down draught, wherever the wind was.

Mr. S. B. Chandler (South Suburban Gas Company) said they must realize the great importance of proper flues from the point of view of consumers. It was most important that everything which was fixed in a living-room, bath-room, or any room where persons were likely to remain for some time, should be adequately ventilated; and it should be one of the aims of distribution men to impress upon builders and architects the advisability of always fixing a flue. He knew it was not invariably done even now; but it should be insisted upon. He had had something to do with an estate on which the supervising architect had agreed partially to eliminate chimney breasts from the houses, and to substitute for the coal-fire a built-in gas-fire. The flues were constructed in the thickness of the walls, and discharged into what were to all intents and purposes coal-fire chimneys. The result was, of course, quite satisfactory.

Mr. F. Ainsworth (Ilford Gas Company) said their thanks were due to Mr. Westbrook for having brought so important a matter before them. Referring to ventilating bricks, he had an idea that the brick used for geysers was better for the purpose of getting the products of combustion away from a fire or from other heating apparatus than the one recently put upon the market for fires. They would have to be very careful in pushing along with these matters.

Mr. Westbrook, in the course of his reply to the remarks made by the various speakers, said he had had some trouble from condensation, but really very little. As to Mr. Winslow's point, he did not want the members to confuse this question of short flues with the "Nautilus" flue. If the builders had adopted the "Nautilus" flue, they would not have had this trouble. He quite believed that that would be all right. It was in his case simply a question of the builder cutting-down costs and putting in the cheapest thing, without caring whether or not it was effective. As to blackening of the walls, in the instance referred to in his paper, no doubt this would take place; but the heat from the flue was not so moist as that from a radiator. The difficulty could be got over by casing.

Canadian Gas Association.—The fifteenth annual convention will be held in Hamilton, Ontario, on Aug. 24 and 25.

Manchester District Institution of Gas Engineers.—The 52nd annual meeting will be held in Manchester, next Friday, March 3. In the morning, by the kind permission of Alderman Kay, J.P. (Chairman of the Gas Committee of the Manchester Corporation), the members are invited to visit the Bradford Road Gas-Works, to inspect the 4 million c.ft. per day units of Glover-West and Woodall-Duckham vertical retorts now in course of erection. Special cars will leave Stevenson Square, off Piccadilly, at 10.45. On the return, for the convenience of members, luncheon will be provided at 1 o'clock in the Midland Hotel, where the business meeting will afterwards take place—at 2.15. In addition to some formal items, there will be the address of the new President, Mr. Harold Davies, of Chesterfield.

AMMONIA AND ITS STABILITY IN THE COKE-OVEN.

At a Meeting of the Midland Section of the Coke-Oven Managers' Association, which took place in the Fuel Department of Leeds University, a paper was read by Mr. H. J. Hodsman, M.Sc., F.I.C., of Leeds University, on "Ammonia and Its Stability in the Coke-Oven."

What scope is there, asked the author, for improving the yield of ammonia in carbonization? The normal yield of ammonia recovered is 15 to 20 p.ct. of the nitrogen of the coal. A somewhat similar proportion is found in the gas as free nitrogen. The proportion found as HCN is only 1 to 2 p.ct., and of secondary importance. The great bulk remains fixed in the coke, and unavailable by normal methods of practice. Any considerable advantage due to methods of conservation can only be secured at the expense of the free nitrogen. If the whole of the free nitrogen were originally liberated as ammonia, the scope would be considerable; some yields might be doubled. There are, however, grounds for believing that some of the nitrogen is always in practice released from the coal, free and elementary. The rest is, presumably, the result of dissociation and oxidation.

These two processes are of primary importance in the destruction of ammonia in the oven—*i.e.* (1) The dissociation of ammonia into its elements at high temperature, and (2) the oxidation of ammonia. There are possibly other avenues of loss—viz., the formation of cyanides and nitrogen compounds of the tar—but these are of minor importance, as the nitrogen balance-sheets show, even if we assume that they are originally derived from ammonia.

Dissociation of Ammonia.

It is well known that ammonia, when heated to a high temperature, tends to decompose into its elements. This process of dissociation falls within the class known as reversible reactions, because the chemical change may occur either in the sense of decomposition or formation of ammonia, depending on the actual conditions existing. This is indicated by writing the equation thus:

$$2NH_3 \rightleftarrows N_2 + 3H_2.$$

Both reactions, decomposition and formation, have their practical interests; the former because of its bearing on the survival of ammonia in the oven, and the latter because of the manner in which it has been used in processes for synthesizing ammonia on a commercial scale.

If we wish to form opinions on the stability of ammonia liable to dissociation (say) in a hot oven free from oxygen, we require to know the conditions of equilibrium obtaining at the particular temperature, and the rate at which the reaction is proceeding towards that equilibrium.

By conditions of equilibrium, I mean the percentage of ammonia in admixture with nitrogen and hydrogen, at which we may regard the processes of decomposition and formation of ammonia occurring with equal rapidity, and therefore just balanced. These are shown in Table I., when the pressure on the mixture is atmospheric, 100 atmospheres, and 200 atmospheres. If we examine this table, we see that at air temperature ammonia should evidently be almost completely stable, with no tendency to dissociate into its elements; whereas in the range of temperature covered in carbonizing practice, the conditions are radically changed, and at 800° C. exactly the reverse is the case. Decomposition, given sufficient time, will continue until practically the whole is broken down into nitrogen and hydrogen. The intrinsic stability of ammonia in the oven is almost *nil*. Nevertheless, the bulk survives, and this because the process is not instantaneous, and the speed of decomposition is sufficiently slow to permit the major portion to escape the ordeal of fire. Thus we can infer from these figures that the apparent stability in practice is governed entirely by the speed of breaking down, and not by the conditions of equilibrium. In effect, the reversibility of the reaction is for carbonizing practice a negligible feature.

Table I.—*Equilibria in the Synthesis of Ammonia.*

Temp. °C.	1 Atm.	100 Atms.	200 Atms.
200	15·3	80·6	85·8
300	2 18	52·1	62·8
400	0·44	25 1	36·3
500	0·129	10·4	17·6
600	0·049	4·47	8·25
700	0·0223	2 14	4·11
800	0 0117	1·15	2·24
900	0·0069	0·68	1·34
1000	0·0044	0·44	0·87

It is well understood that gas reactions usually proceed with much greater rapidity in contact with surfaces than in a free gas space. Surfaces of relatively large area—such as those of the pores of coke and firebrick—have this effect to an intensified degree. This was clearly shown by experiments made in this department by Prof. Cobb and Mr. H. Hollings* in which the

* See "Journal," Vol. CXXVI., p. 917.

TABLE II.

Experiment No.	I	2	3	4	5	V.	6	VI.	7	VII.	8	VIII.	9	IX.	10	X.
Hours after charging	7	8	8	13	16	21	14	19	13	18	16	22	18	23	17	22
Oven temperature at charging, °C.	500	600	700	800	900	900	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Temperature of arch during experiment, °C.	500	550	600	660	710	820	750	870	800	960	870	990	850	1010	860	890
Kg. $(NH_4)_2SO_4$ in 100 cb.m. gas	1·02	1·44	1·42	4·13	5·62	4·16	6 84	3·71	6·92	3·10	6·76	2·76	6·67	2·20	6·71	2·84
Kg. benzole in 100 cb.m. gas	6·8	7 1	6·7	6·3	5·2	4·80	5·2	4·21	4·9	2·12	4·6	1·71	4·5	1·32	4·5	2·14
Tar—																
Kg. in 100 cb.m. gas	29·8	30·2	26·1	20 3	14·6	12 2	13·9	11·8	12·7	10 4	11·8	9 2	12·1	8·6	12·1	9·8
Sp. gr.	1·05	1 06	1 09	1·10	1·12	1·19	1·15	1·19	1·16	1·20	1·18	1·20	1·18	1·21	1·19	1·19
Light oil to 170° in 100 cb.m. gas	9·6	9 9	9·4	7·6	5·1	4·20	4·2	2·18	3·6	1·96	2·4	1·84	2·3	1·77	2·6	1·78
Pitch	31·5	31·8	41·2	42·6	48·6	52·4	52·4	54·6	55·8	58·2	56·3	59 3	56·7	61·2	57·0	58·8
Total Light Oil—																
Kg. in 100 cb.m. gas	16 4	17·0	16 1	13·9	10·3	8·36	9·4	6·39	8·5	4·08	7·0	3 55	6·8	3·09	7·1	4·02
Paraffins	100	100	61	28	Tr.	0·2	..	..	..	..	..	..	..	..	..	..
Naphthalene (tar included)	..	..	..	..	Tr.	0·86	0·46	1·32	1·86	2·44	2·08	4 66	1·94	13 22	2·00	10·42
Gas—																
CO_2	2·2	2·3	2 5	1·9	1·9	9 9	2 0	14·6	2·5	11·4	2 3	12·4	1 8	18·6	2·0	14·7
Benzole	..	Tr.	0·2	0·4	0·8	0·7	0·8	0·8	0·9	0·7	1·1	0 6	1·3	0·5	1·2	0·8
C_2H_4	7·1	6 8	5·4	5·1	3 9	2 1	3·6	2·2	2·9	2·5	2 2	1 9	2·2	1·4	2·3	2 1
O_2	0·9	1·0	0 8	0 9	1 0	1·9	1·1	1·8	1 0	1·4	1·5	1 9	1·3	2 2	1·3	2·6
CO	4·7	5·5	4·6	5·2	5·9	6 2	5·8	6 0	5·3	5·8	6·0	6 6	5·4	5 8	5·8	7·1
H_2	22·4	27·6	34·0	37·6	40·2	36·4	43·1	32·6	47·8	33·4	52·8	31·8	51·6	28·6	52 1	30·4
CH_4	56·3	52 6	49·4	47 1	43·7	32·5	40 2	30 8	38 0	32 4	31 6	30 6	34·4	24·5	32 8	28·6
N_2	6·4	4 2	3·1	1 8	2·7	10·3	3·4	11 2	1·6	12 4	2·5	14 2	2 0	18·4	2·5	13·7
Calorific value—gross kg. cals. per cb.m.	6441	6341	6076	6015	5779	4445	5509	4241	5362	4403	4934	4112	5190	3345	5092	4014
Sp. gr.	0·430	0·412	0·396	0·378	0·398	0 418	0·401	0·419	0 372	0·422	0·394	0·413	0 396	0·420	0·399	0·411

ammonia obtained from the same coal heated in a retort at 800° C. was measured under three separate sets of conditions:

(1) The gas was drawn from the retort with minimum exposure to heat, and 22 p.ct. of the nitrogen of the coal was recovered as ammonia.

(2) The gas traversed a long empty tube heated to the same temperature (800° C.) before passing to the absorption apparatus. The ammonia recovered represented about 17 p.ct. of the nitrogen of the coal.

(3) Here the tube traversed was packed with coke at 800° C. so that the gases were exposed to the influence of heated surfaces, and only 9 p.ct. of the nitrogen was recovered as ammonia.

While these experiments show quantitatively the effect of the different conditions studied, they do not inform us as to what extent these processes take place in practice owing to uncertainty as to the time of contact. Not only the area, but also the character of the surface is important, because of the varying catalytic or speeding-up effect which different substances exert on gas reactions. It happens that iron and its compounds influence strongly the reactions in which ammonia is concerned. Iron is normally present in the coal of the charge and the bricks forming the structure of the coke-oven. Although, so far as I know, the matter has not received attention, correlation of iron content of coal and bricks with carbonization results may be of importance. It is certain that the presence of iron is more likely to be harmful than beneficial; and the salt of the coal may also play a part.

There are grounds for believing that the loss of ammonia in practice by dissociation has been rather over-estimated; and it is by no means certain that this is the main cause of loss of ammonia. The ammonia forms only 1 to 2 p.ct. by volume of the dry gas at the most, and, owing to the large quantity of water vapour liberated in the oven, the proportion is actually considerably smaller. Dilution of the ammonia undoubtedly promotes its conservation—partly because the encounters of the particles of NH_3 with hot surfaces become thereby less frequent, and partly because, owing to the greater volume, the gas is hurried out of the hot regions into the cooler parts of the plant more quickly. It is possible that the water vapour exerts some specific protective influence on the ammonia, restraining or retarding the decomposition into its elements. There is evidence that ammonia carefully dried does not resist decomposition so well as in the presence of water vapour; but whether such a specific protective effect, if it exists at all, is more pronounced in the presence of large quantities of steam, though apparently assumed, has not, so far as I am aware, any experimental basis. Perhaps in the near future we may be able to remedy this defect.

EXPERIMENTS ON A WORKING SCALE.

Some experiments on an actual coke-oven were recently reported by A. Thau. The experiments were apparently undertaken to investigate the relative importance of different factors on the decomposition of ammonia in the oven space above the charge. It was intended to compare the results of simple dissociation by heat, oxidation by air drawn in, and the importance of water vapour, though the last problem had to be left untouched. Thau arranged to run one oven of a Swedish battery, using Durham coal, under special conditions, and drew-off a portion of the gas by a tube inserted in the door, and then through a small cooling and washing train improvised out of oil casks. He was able to follow the changes in yields and composition of the bye-products as the temperatures in the flues and over the charge were considerably varied. As interesting observations on the benzole, tar, and gas were made, I have reproduced his figures as a whole, including the figures bearing on ammonia (Table II.). In Experiments 1 to 10, the oven was kept carefully sealed to exclude air; while the temperature of the flues and the space in the charge were varied. Oxidation phenomena were excluded as far as possible. The effect of higher carbonizing temperatures on the production of ammonia is brought out in Experiments 1 to 7. In Experiment 8, special efforts were made to get the space above the charge as hot as possible; in Experiment 9, the charge was only three-quarters normal, so that the time spent by the gases in the oven space was abnormally long; and in Experiment 10, the oven was cleaned out and lined with "fire cement" before the experiment, to eliminate carbon surfaces. Nevertheless, no great effect on the ammonia content of the gas resulted; and Thau concludes that little loss of ammonia by dissociation occurs in the free space above the charge of an oven.

SYNTHETIC AMMONIA.

If the decomposition of ammonia into its elements may have unwelcome consequences for the bye-product technologist, the reverse reaction has consequences at least as important and fateful, for by this reaction his monopoly has been destroyed. Twenty years ago, the chemical view commonly held was that nitrogen and hydrogen were practically inert to each other at all temperatures. Then followed a period of great experimental activity and rapid progress in the study of gas reactions. This was the result of the wider recognition of the theoretical principles underlying gas reactions, and the development of improved laboratory technique in the production and measurement of high temperatures. With regard to the reaction in question, several physical chemists recognized that here was an equilibrium which could be modified by changing the conditions—namely, by causing combination to occur under increased pressure and in the presence of a suitable contact mass or catalyst. To-day there is apparently plant in Germany on the largest scale capable of producing the equivalent of 1,500,000 tons of $(NH_4)_2SO_4$ annually The monopoly of bye-product ammonia is for ever gone.

Synthetic ammonia must necessarily be produced from carefully purified raw materials if the catalyst employed is to maintain its activity; and as a consequence a product of a high degree of purity can readily be obtained. This will unfailingly set the standard of physical and chemical quality to which bye-product ammonia will have to conform, or become with difficulty saleable. On the other hand, it does not seem likely that synthetic ammonia can oust bye-product ammonia because in a price conflict the synthetic industry depends on one product, and must stand or fall by the ammonia. The gas and coke works would be able to fall back on their main products. The gas engineer has no option but to wash ammonia from his gas.

OXIDATION OF AMMONIA.

In the presence of oxygen, ammonia may be decomposed by oxidation. It is an interesting question as to how far the yields are reduced by this process in practice, and under what conditions the ammonia may be regarded as safe. Is this of more or less consequence than dissociation? The part played by water vapour is another interesting question. In the oxidation for nitric acid production, it is regarded as unimportant. The common view among coking men is that a given coal will yield more ammonia if carbonized in coke-ovens than in gas-works. This is generally associated with the higher moisture content of coke-oven gas produced from wet slack. The water vapour is believed to exert some preservative action not clearly defined. The influence of water vapour was discussed recently by C. E. Foxwell, who went so far as to give a figure—viz., 9 p.ct.—to the proportion of moisture in the slack which will represent the condition of maximum conservative effect. Foxwell, however, appears to conclude that the effect of water vapour is to shorten the time of

TABLE III.

Temp. °C.	Rate of Flow in Litres per half hour.	Percentage of NH_3 Entering.	Percentage of NH_3 Leaving.	Percentage of NH_3 Oxidized.	Percentage of O_2 in Gases Leaving.	Percentage of O_2 Used.	Remarks.
250	3·727	2·335	2·315	0·89	20·70	0·10	Gas sat. 20° C.
250	4·003	2·356	2·218	5·86	20·45	0·35	Dry gases.
400	3·956	1·573	1·543	1·95	20·65	0·15	Gas sat. 20° C.
400	3·960	1·588	1·454	8·41	20·40	0·40	Dry gases.
450	3·823	1·723	1·688	2·01	20·55	0·25	Gas sat. 20° C.
450	3·999	1·754	1·528	12·89	20·15	0·65	Dry gases.

contact between the gas and the hot coke. Does the presence of moisture restrain oxidation?

First, let us ascertain what is the nature of the oxidation process. If ammonia is oxidized or burnt at a high temperature, the result in general is the formation of free nitrogen and water, thus:

(1) $4NH_3 + 3O_2 = 2N_2 + 6H_2O$.

If, however, the reaction occurs in the presence of a suitable catalyst or constant mass, nitric oxide may be produced, thus:

(2) $4NH_3 + 5O_2 = 4NO + 6H_2O$.

This is an important process, because if the temperature and conditions are suitably chosen the production of nitric oxide can be made almost quantitative, and, as is well known, the reaction is used for the production of nitric acid from ammonia. If too high a temperature be chosen, the yield of nitric oxide falls off owing to the production of free nitrogen; nitric oxide being unstable at fairly high temperatures. If the temperature be such that oxidation is slow and incomplete, the yield of nitric oxide which has escaped oxidation may be reduced owing to a reaction with the excess of ammonia, thus:

(3) $4NH_3 + 6NO = 5N_2 + 6H_2O$.

Equations (2) and (3) together have the same results as (1).

Although it is quite easy to obtain oxides of nitrogen by the oxidation of ammonia, nitrates or nitrites are never found in the products of carbonization. If formed, they would be decomposed by unchanged ammonia and other reducing compounds present. In the oxidation of ammonia during carbonization we need only concern ourselves then with reaction (1). In contrast to the dissociation process, this reaction is entirely of the non-reversible type. It is in no degree limited by the attainment of any condition of equilibrium. At all temperatures—air temperature and upwards—ammonia in the presence of oxygen is in an intrinsically unstable condition. The survival of ammonia at all is conditioned by the time available and the speed of the reaction at the temperature in question. It is then of considerable interest to know under what conditions of time and temperature the ammonia of coal gases is practically speaking safe from destruction by this reaction.

Some conclusions have been drawn by Sommer from experiments published in "Stahl und Eisen," 1919. Sommer appears to believe that in coal gas containing oxygen, the possibility of decomposition of ammonia exists at temperatures below a red heat, possibly as low as 250° C. Most remarkable is the inference that quite small proportions of water vapour appear to have an extraordinarily powerful effect of restraining oxidation, and thus preserving the ammonia. The interest of these conclusions, both theoretical and practical, is great; and the table of these experiments is reproduced (Table III.).

In these experiments, air containing about 2 p.ct. of NH_3 was passed through a porcelain tube packed with firebrick and heated to temperatures ranging from 250° to 450° C., and the loss of ammonia was determined. Sometimes the air was dried and sometimes saturated with moisture at the laboratory temperature. It will be seen that while at 450° C. 12·89 p.ct. of the ammonia was lost in dry gases, the loss was only 2·01 p.ct. when about 2·3 p.ct. of moisture was present (saturation at 20° C.). Sommer hazarded a conjecture that the action of the water vapour was to form a more stable compound NH_4OH with pentavalent nitrogen. From a theoretical point of view, this is exceedingly interesting, but seems to be a pure speculation. There is no experimental evidence of the existence at high temperatures of such a compound. As regards carbonizing practice, Sommer appears to take a somewhat alarmist view as to the danger of loss of ammonia by oxidation. If the oxidation of ammonia goes on to an appreciable extent in the carbonization plant at temperatures below a red heat, it is an important matter to the coke-oven technologist to know under what conditions the ammonia is safe. Sommer's published observations are few in number, not quite satisfactory in certain particulars, and, so far as carbonization practice is concerned, inconclusive; for the experiments were all made on ammonia admixed with air—*i.e.* (say) 2 p.ct. of ammonia with about 20 p.ct. of oxygen and about 80 p.ct. of inert nitrogen. This is in no way representative of the conditions in a crude coal distillation gas. From further experiments on the oxidation of sulphuretted hydrogen in the presence of air, Sommer concluded that the presence of sulphur compounds in crude gas was beneficial. They were apparently more readily oxidized than the ammonia, and therefore presumably would have the effect of deoxygenating the gas. Although these experiments can also scarcely be regarded as conclusive on this point, the presence of sulphite, thio-sulphate, and sulphates in ammonia liquor, does suggest that the absorption of oxygen by the H_2S may have a protective effect towards the ammonia.

In view of the theoretical and practical interest of Sommer's statements, it was deemed desirable to investigate the matter further. The results of this work, carried out in the laboratories at the Leeds University by Prof. H. D. Drummond, M.Sc., and Mr. R. A. Mott, B.Sc., under the author's direction, will be published in detail later. Mixtures of gases with about 2 p.ct. of ammonia (air, nitrogen with 1 p.ct. oxygen, coal gas with 1 p.ct. oxygen) were passed over contact masses heated to various temperatures. Sometimes the gases were carefully dried; sometimes saturated with moisture at determined temperatures. The time of contact was adjusted to correspond approximately with what was believed to be that in gas-works practice. The percentage of ammonia in the mixture before and after passage was determined. From our experience, results with air-ammonia mixtures could not necessarily be taken as a guide to the behaviour of coal-gas-ammonia mixtures—*i.e.*, coal gas containing oxygen. For instance, no destruction of ammonia by oxidation has been detected in coal-gas-ammonia mixtures containing 1 p.ct. of oxygen at any temperature below 600° C., and indeed no extensive decomposition below 700° C. Even with air-ammonia mixtures, measurable oxidation was not observed below 400° C. Sommer, in contemplating decomposition at temperatures so low as 250° C., appeared to exaggerate the danger. When air-ammonia mixtures were used, the rate of oxidation was considerably influenced by the nature of the contact material, and there were grounds for believing that the presence of oxide of iron was important in promoting decomposition. The nature of the contact material seemed of less importance, however, when coal-gas ammonia mixtures were employed. Indeed when, as contact mass, coke, fused silica, and unused firebrick (Farnley) were employed, no difference could be detected. The rates of decomposition were practically identical. Nevertheless, in practice one has to deal with brick material which has become impregnated with oxide of iron, volatilized from the coal with the salt vapours; and experiments were made with such a material supplied by Mr. C. Dinsdale, of Blackwell Coke-Ovens. These are now in progress; but so far the results indicate that this material does promote the oxidation of ammonia which comes in contact with it. The rate of oxidation is about twice as great at 700° C. as that observed when the unused brick was employed. Nevertheless, below 600° C. the destruction was even there too small to be measured. All the above observations were made on dried gases.

So far as the effect of moisture is concerned, we found again that the results of experiments with air-ammonia mixtures were no safe guide to those with other mixtures. Air-ammonia mixtures in contact with unused firebrick (*i.e.*, as used by Sommer) did show a smaller rate of oxidation of ammonia when moisture was present (2 to 3 p.ct. by volume) than when the gases were dry. The effect was unmistakable, even when only 2 to 3 p.ct. of water vapour was present, though not so pronounced as the effects observed by Sommer. At 640° C. we found the loss by oxidation at 33 p.ct. in dry gases, and only 23 p.ct. in the moist. Sommer's experiments indicate a much more drastic influence of the water vapour. This productive effect, however, has not usually been observed in our experiments with the coal-gas-ammonia mixtures. This is not really surprising, for the hydrogen of a coal gas is always capable of reacting with oxygen above 600° C. to produce water vapour, even if none was present initially. Even a dried mixture may become moist at the high temperature; while the oxygen is thereby removed.

These results so far require us to use caution in ascribing specific preservative action to the moisture present in crude coal gas. If any preservative action be exerted, it may be of a physical nature only, due to the diluent effect of the larger proportions of water vapour, and also to the consequent hurrying out of the ammonia through the danger zone.

Thau, in the experiments referred to earlier, also sought to ascertain the conditions under which oxidation of ammonia occurred in the space above the charge. The results are given under the Roman numerals in Table II. In experiments V., VI., &c., to X., the conditions of the experiment under the corresponding numbers 5, 6, &c., to 10, were varied by blowing oxygen gas from a cylinder into the space above the charge. Similar experiments were made at the lower temperatures (experiments 1 to 4), but no effect on ammonia yield was observed—*i.e.*, when the oven temperature was below 600° C. the admission of oxygen to the crude gas was attended by no appreciable loss of ammonia. At high temperatures the effects were very considerable. The admission of oxygen caused overheating of the gas in the free space by 120 to 160° C. The yield of ammonia fell at the same time by as much as two-thirds. Though the process appears drastic, the contrast with the apparent stability of the ammonia in the absence of oxygen is very impressive. Furthermore, it is interesting to note that the temperature of the oven at which the destructive effect of oxygen became undoubtedly appreciable—600° C.—

agrees with the observations made in our laboratory experiments. The effect on the gas and tar is also very marked.

It must be clearly understood that in this paper we are solely concerned with the conservation of ammonia already formed. Water vapour has, of course, a chemical action, liberating the nitrogen of the coke as ammonia. This, however, is another matter dealt with at length by Dr. Monkhouse and Prof. Cobb.* Any effect which water vapour may exert on the ammonia yield is likely to be fairly complex; and it is desirable to sort these one from another.

There still remains the small proportion of the nitrogen which is found in the cyanide compounds and in the tar—usually a total loss. Altogether it represents only a few per cent. of the original nitrogen; and no great improvement of the yields of ammonia can be sought in that direction. If possible, it would be preferable to recover cyanide. The economic position is such that only a proportion of town gas is washed from cyanogen compounds, although the gas engineer has good reason to remove them if at all possible. At coke-ovens the prospects are poorer. Attempts, however, have been made to convert cyanides into ammonia; the yield being thus improved. Mr. E. V. Evans and the South Metropolitan Gas Company proposed to effect this by heating the sulphocyanide with sulphuric acid under suitable conditions. A similar proposal was made by Sommer, who suggests superposing a column of trays above the saturator. The sulphuric acid is to be fed into the bath by this column, and the waste gases, in leaving, bubble through the acid and are thereby deprived of hydrocyanic acid, which is recovered as ammonia. It remains to be seen whether the results in practice will justify the complications involved.

* See "JOURNAL," Vol. CLVI., p. 234.

Mesothorium and the Light of the Future.

A prophecy as to what the light of the future will be was ventured by Mr. S. Gulbrandsen, in an address to the New York Section of the American Illuminating Engineering Society, who declared that it will be produced by phosphorescence. By "future," he meant twenty, fifty, or even hundreds of years hence. The present methods of lighting, both gas and electric, he said, remind him of the Chinaman who burned down the house to roast the pig. In both cases only a fraction of 1 p.ct. of the energy of the coal pile is returned to us in the form of light. Some day we are going to find a method of producing light without the accompaniment of such a vast quantity of heat. In fact, it is already being done in a small way in commercial work. He produced an Ingersoll watch, the dial of which was treated with self-luminous paint composed of phosphorescent zinc sulphide mixed with a minute quantity of radium or mesothorium. Mesothorium (which occurs together with thorium in monazite sand, and is recovered during the process of manufacturing thorium) is one of the radio-active elements very similar to radium in properties—in fact, so similar to radium that it cannot be separated from it. Exhibiting a tube, he said: I have here a tube containing about 35 mg. of mesothorium—worth perhaps a couple of thousand dollars. Now, 35 mg. is about one-thousandth of an ounce. When I speak of 35 mg. of mesothorium, I do not mean 35 mg. in actual weight. I mean the amount of mesothorium which gives the same radio-active power as 35 mg. of radium. The actual weight of mesothorium present would probably be one-three-hundredth of this, or about one-three-hundred-thousandth of an ounce. This minute quantity might easily represent a week's production of mesothorium. Besides being used for watches, this luminous paint has other applications. The problem of the future is to take the results with which we are already familiar, and multiply them by a hundred, or perhaps several hundred. Surely this offers a most attractive field for research.

Reduction Recommended at Leeds.—The Leeds Gas Committee, on Tuesday of last week, decided to recommend a reduction in the price of gas by 3d. per 1000 c.ft., as from April 1. The present charge is 5s. 3d. per 1000 c.ft., less 5 p.ct. discount for prompt payment.

Lea Bridge District Gas Company.—The report for the past year to be submitted at next Tuesday's meeting states that the miners' strike caused great anxiety to the Directors, and expense to the Company, whose business, however, was continued without inconvenience to the consumers. The Company's application to the Board of Trade for an Order under section 1 of the Gas Regulation Act was granted on June 27. Under this Order, the Company's standard price of gas was altered from 4s 6d. per 1000 c.ft. to 16·8d. per therm (equivalent to 6s. 3⅜d. per 1000 c.ft.). A further Order under section 10 of the Act was granted to the Company on Aug. 17, authorizing the holding of yearly instead of half-yearly meetings. The highest price charged for gas by the Company during the past half year was 1s. 2d. per therm. As from Jan. 1 this year, the price of gas has been reduced to 1s. 1d. per therm. The sale of gas for 1921 shows a decrease of 1·23 p.ct. The amount available for dividend, including the sum of £4728 brought forward, is £13 484; and from this sum the Directors recommend the declaration of dividends at the rate of 5 p.ct. per annum on the preference stock and 6½ p.ct. per annum on the consolidated ordinary stock (both less income-tax), and that the sum of £205 be carried to the credit of the reserve fund, leaving £7664 to be carried forward to the credit of the current year's account, after appropriating £2700 to the special purposes fund and £1490 to the benefit fund.

INSULATING HOT TANKS.

Dealing with the question of saving resulting from the insulating of hot tanks, Mr. W. L. Steffens, of Cincinnati, writing in the "Gas Age-Record," says that in the prepared roofing industry it is necessary to carry stocks of asphalt oils; and for this purpose large outdoor storage tanks are used. These oils are so viscous that it is necessary to keep them heated by means of steam-coils to a temperature of something over 200° Fahr., in order that they may pass through the pipelines. Recently one roofing manufacturer had an estimate made of the heat losses from his bare oil-storage tanks and of possible savings to be made. The estimate indicated that such remarkable savings could be made by insulating these tanks that it was considered worth while to run an actual test on one of the bare tanks, then cover it, and repeat the test under practically the same weather conditions, in order to verify the estimate. The test was made in each case by determining the amount of steam required to keep the tank hot for a given period of time, by the simple process of measuring the condensed steam from the heating coils. The insulation used was 1 in. thick Carey "Carocel" asbestos board, and ½ in. thick asbestos cement. The insulation was covered with a roofing jacket, to protect it from the weather. The figures of cost and saving revealed by the test showed that the cost of insulation would pay for itself in eight months. The tank tested was one of a group; and in this particular instance hot tank insulation is saving the manufacturer approximately 2600 tons of coal a year. "Many people," remarks Mr. Steffens, "think they cannot afford to insulate hot surfaces. The test simply shows that in such cases a man pays the price of insulation every few months, whether he can afford it or not. What he really cannot afford is not to insulate."

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

"The Five-Legged Rabbit."

SIR,—I do not object to reply to criticism from members of the gas profession, but shall not reply to the letter of Mr. E. F. Murray, who is outside that profession. I am sure Mr. Marshall is quite able to look after himself without his assistance.

Mr. Murray was in my employ for a few months; and since I dispensed with his services, I have developed on new lines, of which, fortunately, he knows nothing—hence his remarks.

Grey House, Carlton-on-Trent, Feb. 24, 1922. C. B. TULLY.

Cost of Gas-Mains for Housing Schemes.—At the Baildon District Council meeting last week, complaint was made that new Council houses were without gas, though tenants were in them. The Shipley Council had offered to lay mains on payment of half the cost by Baildon, *plus* a charge for service-pipes beyond 30 yds.; and the Clerk said the Housing Commissioner had expressed the view that the terms were excessive. Certain members of the Council suggested that the Shipley Council could be compelled to lay the mains; and the Chairman and Clerk were deputed to interview the Shipley authorities. A statement made subsequently on behalf of the Shipley Gas Department is that there is no obligation on that authority to extend the gas supply to the new houses, and that if they did supply they would be quite within their rights, if they chose, in charging the full cost of the gas-mains to the Baildon Council.

Gas the Fashion in Suicides.—Mr. F. H. Robinson, the Engineer and Manager of the Harrogate Gas-Works, lectured on gas last week before the Harrogate Rotary Club; and in a reference to the epidemic of gas poisonings, remarked that nobody could prevent people from putting their heads in a gas-oven or committing suicide by other misuses of gas, if they chose to do so. Gas seemed to be the fashion in suicides at present—just as poisons, shooting, drowning, and other forms of self-destruction had had their turns. Accidents happened to people who insisted on sleeping with closed doors and windows, keeping out fresh air. Mr. Robinson observed that the greatest advances had been made in the gas industry since the introduction of incandescent mantles and electric lighting. Shareholders in gas companies had had a fit of nerves when electricity was first introduced; but far from gas being superseded by electricity, the progress of gas for lighting, heating, and power had been much more marked than ever before. Competition had made the industry awaken out of its lethargy; and it had a great future in its many phases of public service.

Suggested Tully Plant for Leigh-on-Sea.—At a meeting of the Southend Gas Committee, Mr. H. King Hiller attended and furnished the Committee with particulars of a Tully plant which he had suggested could be installed at the Leigh Gas-Works. He stated that he had now made an inspection of the works, but could not recommend the provision of such a plant therein unless the land belonging to the undertaking situate on its south and west sides is reclaimed and used for the manufacture of gas, thereby enabling extensions to be made to some of the existing plant, which are essential if additional gas-making plant is to be installed. After giving the matter careful consideration, it was resolved that the Borough Surveyor be requested to furnish the Committee with alternative estimates of the cost of providing a sea wall for enclosing the whole of the land belonging to the undertaking, and that portion only lying to the west of the site of the existing works. The Committee accepted an offer made by Mr. King Hiller to supply them with a detailed report upon the Tully gas plant and the extensions which it would be necessary to make to the existing plant if the system were to be adopted.

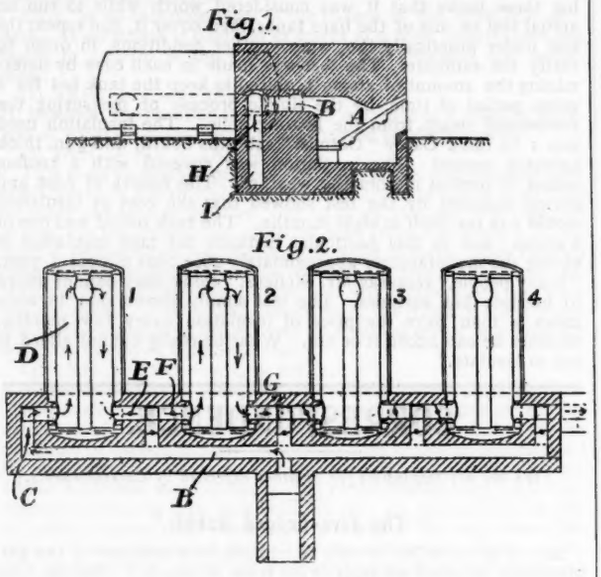
REGISTER OF PATENTS.

Distillation Apparatus.—No. 157,849.

CHEMISCHE FABRIKEN WORMS AKTIENGESELLSCHAFT, of Frankfurt-am-Main.

No. 1575; Jan. 10, 1921. Convention date, Aug. 6, 1917.

An obvious construction of a still, the patentees remark, is one analogous to a horizontal fire-tube boiler. In such boilers the tubes are sometimes constructed U-shaped, so that only the front tube-plate is required; but the present invention avoids the end tube-plate by bringing the ends of the U-tube through the sides of the still.



A German Distillation Apparatus.

In the accompanying drawings an installation of four stills intended for distilling coal tar is shown. Fig. 1 is a vertical longitudinal section; fig. 2 is a horizontal section through the stills and the upper flue. Stills 1 and 2 are supposed to be in use. Combustion products from the furnace A pass through the upper flue B, past the open valve C, and enter the U-tube D in still 1 through the side thereof. Having traversed still 1, they flow past the open valves E F into still 2, which they traverse in like manner, finally passing the open valves G and H to enter the waste-gas flue I.

In this case still 2 becomes a pre-heating still—that is to say, it contains fresh tar which is dehydrated by the heat of the gases passing through the still—while still 1 is that in which distillation proper occurs. By suitable adjustment of the various valves, as will be obvious, all four stills may be traversed by the gases in succession in the order 1, 2, 3, 4, in which case 4 may be the dehydrating still, 3 the light oils still, 2 the middle oils still, and 1 the pitching still.

Combustion of Bituminous Fuels with Recovery of the Bye-Products.—No. 152,668.

STRACHE, Prof. Dr. H., of Vienna.

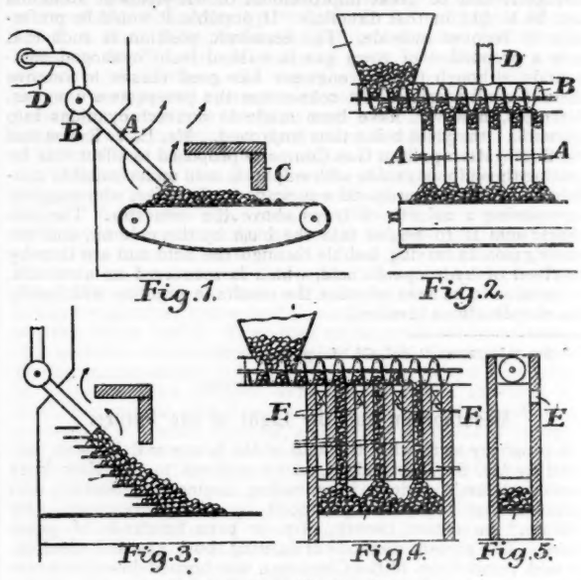
No. 29,551; Oct. 19, 1920; Convention date, Aug. 6, 1919.

This invention relates to the recovery of bye-products from bituminous fuels by degasification wherein the residues remaining after degasification are burnt in a furnace and the degasification is effected by the gases of combustion. Proposals have been made to recover bye-products in this manner from the bituminous fuels to be burned in steam generator and other furnaces by conducting a portion of the gases of combustion of the residues through flues to effect the degasification of the fuel in a retort arranged near the furnace, as disclosed in specifications No. 6563 of 1900 and No. 110,385. According to the present invention, however, the bituminous fuels are degasified in the furnace itself by the heat of the whole of the gases of combustion of the residues and/or by the radiation of heat from heated parts of the furnace.

The fuel is supplied out of contact with air through pipes or retorts, which are arranged in the furnace itself, on to the grate of the furnace; and all the gases produced during the firing are conducted by the aid of fire-bridges round these pipes or retorts. At the same time an additional inward heating of the fuel is effected by sucking a part of the gases of combustion through the retorts so that the gasification of the fuel is accomplished by outwardly and inwardly heating as it passes through the pipes or retorts. The gases resulting are conveyed to suitable apparatus for separating the bye-products, and may thereafter be conducted back to the furnace to be consumed therein. (In patent No. 1630 of 1880 it was proposed to degasify the combustible material in a retort placed in the flue or fire-box. In that case there is no part of the gases of combustion led through the retort, and the necessary extraction of the coke formed in the retort renders continual working impossible).

Fans or blowers for producing a forced draught may be employed; and if by this method a sufficient pressure is produced in the furnace, the use of a fan or blower for conveying the gas may be dispensed with. The distillation gases will then be conveyed by the pressure in the furnace chamber to the apparatus for separating thebye-products.

Figs. 1 and 2 show a furnace with a travelling grate. A are the pipes which deliver the fuel from the coal-conveyor to the furnace, which is provided with a conveyor worm B and a coal-bunker. These pipes, in consequence of the built-in fire-bridge C, are surrounded by the gases of combustion, so that the required degasification of the fuel passing down these pipes is effected. The gases resulting from the degasification are drawn off by the fan or blower D, and may be employed for any desired purpose. The gases may, however, after the separation of the bye-products be conveniently conveyed in a uniform current to the furnace. In order to obtain a uniform current of gas, the fan or blower need only make a regular number of revolutions; and in the case of alterations in the volume of gas produced, a small



Strache's Degasification Process.

gasholder may be employed for the purpose of compensating these irregularities. Fig. 3 shows the same arrangement with a step grate. In the arrangement shown in figs. 4 and 5, the coal is brought through passages on to a flat grate. The gases of combustion produced on this grate pass through heating flues and thus heat the passages containing the coals. The hot gases of combustion then pass through the openings E out into the furnace chamber.

Manufacture of Neutral Sulphate.—No. 173,818.

HANSFORD, J. B., of Bedford.

No. 25,505; Sept. 4, 1920.

[For a full description of the plant and process described in this specification, readers are referred to the "JOURNAL" for Sept. 28, 1921, pp. 721-3.]

The invention has for its object the continuous production of neutral sulphate of ammonia in the crystalline form in the saturator in which the conversion of gaseous ammonia into sulphate of ammonia is effected. The apparatus is constructed with a primary and a secondary saturator, which are so connected with each other and with the ammonia gas supply and waste-gas outlet that the ammonia can be passed through either saturator or through both in series or in parallel. This arrangement enables the ammonia to be passed into sulphuric acid contained in the primary saturator until ammonia gas comes-off, when the escaping ammonia is led into the secondary saturator; the main supply of ammonia being diverted to the secondary saturator when neutrality has been reached in the primary and while the neutral sulphate of ammonia crystals are being removed therefrom. The liquor is then transferred from the secondary to the primary saturator, both baths being made up with sulphuric acid, and the sequence of operations repeated.

Clearing Ascension Pipes.—No. 174,276.

OWEN, O. H., and GOODRIDGE, A. J., of Sutton.

No. 35,567; Dec. 18, 1920.

This specification describes a steel rod having at its end six branches, leaving the rod at an angle of 45 degrees, curving outwards and then inwards, when they are all welded together and finished off to a sharp pointed end. The branches are triangular, having the base of the triangle on the inside, and the apex on the outside, and act as cutting edges for the purpose of removing accumulated deposits from the inside of the pipes.

Lubricating and Cleansing Coal-Gas Exhausters. No. 174,439.

SMITH, J., of Cardiff.

No. 30,175; Oct. 26, 1920.

This invention relates to an improved method of, and apparatus for, lubricating and cleaning coal-gas exhausters, whereby the use of lubricating oil is rendered unnecessary and the exhausters are progressively

cleansed and freed from tar, which ordinarily causes trouble by clogging the pistons or drums and other internal parts of the exhausters.

The specification describes an arrangement to convey a constant stream of gas liquor through a system of pipes, either by gravity from an overhead liquor tank or by pressure from a liquor pump, and to cause this liquor to flow through the working parts and bearings of exhausters. In applying the invention, for example, to an exhauster of the rotary type, the centre spindle is connected by a pipe (which is regulated by a valve) from an overhead gas liquor tank, so as to give the exhauster a constant flow of liquor. The spindle can also be connected in the same way to the gas-liquor pump. By this installation the exhauster is kept free from tar, and no oil is needed for lubricating.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Feb. 22.]

Nos. 4115 to 4864.

ALLENDER, J. J.—See Stoves, Ltd. Nos. 4404, 4534.
ANDERSON, T. G.—"Recording meters, &c." No. 4539.
ANDERSON, T. G.—"Coin feed and freed apparatus." No. 4540.
BARHAM, H. G. H.—"Burners for heating." No. 4273.
BRITTEN, W. M.—"Gas-burner," No. 4354.
BROWN, W. H.—"Gas-stoves." No. 4373.
CARR, M.—"Starting rotary, &c., exhausters." No. 4416.
COMPAGNIE POUR LA FABRICATION DES COMPTEURS ET MATÉRIEL D'USINES À GAZ—"Large-capacity gas-meter." No. 4348.
EGELING, H.—"Saturators for recovery of salts from gases of dry distillation." No. 4745.
GOAD, G. A.—"Gas water-heater." No. 4592.
GOLDSBROUGH, R. E.—"Gas-producer for fluid carbohydrate fuel." No 4564.
HALSHMAN, C.—See Britten, W. M. No. 4354.
HELPS, G.—"Gas burners and cookers," No. 4820.
HUGHES, J. P.—"Portable gas-stoves." No. 4238.
HUNTER, C.—See Moore, S. Nos. 4471, 4472, 4572.
HUNTSWORTH, G. H.—See Anderson, T. G. Nos. 4539, 4540.
JONES, F. H.—"Gas-burners," No. 4749.
KENNEDY, W.—"Gas-heaters." No. 4577.
LANDIS AND GYR AKT.-GES.—"Coin-freed mechanism for prepayment meters." No. 4611.
MACLAREN, A. F.—"Distillation of coal, &c.; and production of briquettes." No. 4511.
MANNOCK, C. M.—"Utilization of blast-furnace gas." No. 4426.
MOORE, S.—"Means for controlling supply of steam for water-gas generators, &c." No. 4471.
MOORE, S.—"Automatically regulating secondary supply of air to gas generators." No. 4472.
MOORE, S.—"Removing coke or ash from gas-generators, &c., and supporting fuel therein." No. 4572.
NOLAN, H. G.—"Geysers, &c." No. 4451.
OTTO AND CO. GES., DR. C.—"Vertical chamber furnaces." No. 4230.
PEASE AND PARTNERS, LTD.—"Manufacture of sulphate of ammonia." No. 4224.
PROCTER, W. F.—See Goad, G. A. No. 4592.
QUINAN, K. B.—"Distillation of hydrocarbon-yielding material." No. 4738.
QUINAN, K. B.—"Distillation of complex materials." No. 4739.
ROBERTS, G. W. P.—"Means for measuring coal, &c." No. 4331.
SAFE SUPERHEAT, LTD.—See Maclaren, A. F. No. 4511.
SOC. CHIMIQUE DE LA GRANDE-PAROISSE (AZOTE AND PRODUITS CHIMIQUES).—"Purification of gases for synthetic production of ammonia." No. 4773.
STEPHENSON, G.—See Pease and Partners, Ltd. No 4224.
STIMSON, E. F.—"Geysers, gas-fires, &c." No 4687.
STOVES, LTD.—"Cooking, &c., ovens." No. 4404.
STOVES, LTD.—"Plate, &c., heating racks for cooking-stoves, &c." No. 4534.
TAYLOR, H. A.—See Hughes, J. P. No. 4238.
WILSON GAS-METERS, LTD., and WILSON, J. H.—"Coin-freed gas-meters." No. 4159.

Elland Gas Company.—At the annual meeting of the Elland-cum-Greetland Gas Company, the Chairman (Mr. W. E. Dyson) drew attention to the extraordinary cost arising out of the coal stoppage, as a result of which the undertaking had a net loss of £3464 on the year's trading, and money from the accumulated funds had had to be used to meet the deficiency. The consumption of gas was 143 million c.ft., a decrease of 7¾ millions on that of 1920. A dividend of 4 p.ct., making 5¾ p.ct. with the 1¾ p.ct. of the June half year, was declared.

Rochester, Chatham, and Gillingham Gas Company.—At the recent annual meeting, the Directors reported that the application for an Order under section 1 of the Gas Regulation Act was heard by the Board of Trade; and the Order was made on June 23. The sales of gas last year showed an increase of 6·1 p.ct. over 1920. The coal strike, which lasted three months, caused the Directors much anxiety. Though the stocks at the commencement of the period were large, it was necessary to purchase foreign coal at exorbitant figures, with the result that the price of gas had to be increased. The Board were pleased to report that they had been able to enter into contracts for coal supplies at lower prices; and these, together with less labour costs, allowed the charges for gas to be reduced at September and December last. It is hoped to make still further reductions; but this is largely dependent upon the prices obtained for residual products, which are much lower than in the previous year. An issue of debenture stock in March last was largely over-subscribed. A dividend at the rate of 5 p.ct. per annum on the consolidated ordinary stock (less income-tax) was paid in August last in regard to the half year ended June 30; and the Directors recommended a dividend at the rate of 5¼ p.ct. per annum (less income-tax) for the half year ended Dec. 31.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

The following Bills have been committed: Bolton Corporation, Doncaster Corporation, Ramsgate Corporation, Stretford and District Gas Board, Stoke-on-Trent Corporation (Gas Consolidation).

Chester United Gas Company.

A petition of the Chester United Gas Company, for leave to introduce a Bill to make new provisions as to the charges to be made by the Company, and for other purposes, together with a copy of the proposed Bill, was read, and referred to the Examiners.

Petitions against Bills.

Petitions have been deposited against the Bolton Corporation Bill, by the London Association of Accountants, Ltd.; the Doncaster Corporation Bill, by the Barnsley and District Traction Company, Ltd., Midland Railway Company, and the West Riding County Council; the South Wales Electrical Power Distribution Bill, by the Aberdare and Aberaman Consumers' Gas Company and other gas companies in South Wales.

HOUSE OF COMMONS.

Progress of Bills.

The Windsor Gas Bill: Read a second time, and referred to the Examiners of Petitions for Private Bills.

The Blackburn Corporation Bill, to confer further powers with respect to the gas undertaking, and for other purposes, was presented and read the first time.

No Standing Orders being applicable to the Kilmarnock Gas Provisional Order Bill, it has passed the second reading.

Gas Regulation Act, 1920.

Copies were presented to both Houses of drafts of Special Orders proposed to be made by the Board of Trade under section 10 of the Act on the application of the Rushden and Higham Ferrers District Gas Company, Borough of Stafford, Swansea Gas Light Company, Borough of Torquay, Dursley Gas Light and Coke Company, Ltd., and the Newport (Mon.) Gas Company.

Public Utility Companies (Capital Issues) Act, 1920.

Copies were presented to both Houses of reports by the Board of Trade under the Act on applications by the Basingstoke Gas Company, Burgess Hill and St. John's Common Gas Company, and the Torquay Gas Company.

Newcastle and Gateshead Gas Company's Prices.

Mr. BALDWIN, the President of the Board of Trade, in reply to a question addressed to him last week by Major BARNES, said the new standard prices of the Newcastle and Gateshead Gas Company were based upon detailed schedules submitted by the Company, showing the costs of, and incidental to, the production and supply of gas in the last financial year prior to the war, and at the date of the inquiry. The additional cost was found to be 7·8d. per therm. He was not aware what were the costs at the present time.

Gas Poisoning Questions.

Mr. T. P. O'CONNOR asked the Minister of Health whether, in view of the recent fatalities in Liverpool, where a family of four have lately died owing to gas poisoning, any steps were going to be taken with regard to the use of water gas in that city and elsewhere to protect the lives of the public.

Mr. BALDWIN (the President of the Board of Trade), who replied, said that, in accordance with the recommendations of the Carbon Monoxide Committee, an Order was made by the Board of Trade on Feb. 16, prohibiting the supply for domestic purposes of gas containing carbon monoxide unless such gas possessed the distinctive pungent smell of coal gas; and the Board were carefully watching the position. There had, however, been no marked change recently in the proportion of water gas supplied by gas undertakings.

Mr. F. GREEN asked the Home Secretary whether experiments on the results of gas poisoning were being conducted at Porton, near Salisbury; and, if so, what animals, and in what number, were being used.

Sir L. WORTHINGTON-EVANS, who replied, said the answer to the first part of the question was in the affirmative. The animals employed were rabbits, rats, and goats; and the total numbers used to date were 26, 23, and 2 respectively. The experiments were of the same nature as those carried out with animals in the course of general medical research at universities, hospitals, and other recognized institutions, and they were under the same statutory safeguards.

NOTICE OF PARLIAMENTARY BILL.

Croydon Gas.

Notice is given by the Croydon Gas Company of their intention to apply for a Bill in the present session of Parliament to authorize them to change the name of the present "D" stock of the Company to "maximum dividend stock;" to provide for the conversion of the existing "A," "B," "C," and "E" stocks into a new stock to be called "sliding-scale stock" and into "maximum dividend stock;" to make provisions with regard to standard price and sliding-scale; for the raising of additional capital; for the offer of stock at a fixed price to consumers and employees; to issue redeemable preference and debenture stock; to hold annual instead of half-yearly meetings; to regulate the supply of gas; and for other purposes.

LEGAL INTELLIGENCE.

AN ALLEGED BREACH OF CONTRACT.

Wexford Gas Company's Coal Deliveries.

Before Mr. Justice Dodd and a Special Jury, in the High Court of Ireland, Dublin, the Wexford Gas Consumers' Company, Ltd., sued the Great Southern and Western Railway Company of Ireland for damages, laid at £500, for alleged breach of contract in connection with the discharging of three cargoes of coal at Rosslare Harbour (co. Wexford), which had been conveyed for the plaintiffs from Maryport in vessels specially chartered by the Gas Company.

The plaintiffs' case was that the defendants had agreed to provide all necessary equipments for the discharge of vessels, and had failed to do so, with the result that for the delay the Gas Company had to pay £278 10s. in demurrage. The defendants alleged that the agreement, if any, was subject to the provision that there should be berthage and cranage available, and that the detention and delay (if any) was due solely to the fact that these were not available; and for this defendants held they were not responsible.

Mr. LYNCH, K.C., for defendants, asked for a direction on the grounds that there was no evidence of contract, and that, having regard to the construction of Rosslare Harbour and its limited accommodation for the discharge of coal vessels, it was unreasonable to expect the defendants to guarantee at all times adequate and immediate facilities.

Mr. JELLETT, K.C., for the plaintiffs, argued that there was an agreement, and contended that the defendants had not discharged the duty imposed upon them by Statute.

Mr. Justice DODD held that the defendants were bound to provide reasonable facilities, and to use reasonable diligence to have wagons to convey the coal to Wexford. He allowed Mr. Jellett leave to amend the pleadings.

The Jury returned a verdict for the defendants; finding that they did not enter into the contract alleged, and that they afforded the usual facilities.

Judgment was accordingly entered for the defendants.

MISCELLANEOUS NEWS.

GAS REGULATION ACT APPLICATIONS.

The following further notices have appeared in the "London Gazette" of applications to the Board of Trade under the Gas Regulation Act.

SPECIAL ORDER.

County Borough of Southport.

Notice is given by the Corporation of an application for a Special Order empowering them to purchase additional lands for the purposes of their gas undertaking, to construct further gas-works, and to borrow more money.

DECLARATIONS OF CALORIFIC POWER.

Banbury Gas Light and Coke Company.—450 B.Th.U. (April 1.)
Brentwood Gas Company.—450 B.Th.U. (March 29.)

[By an error on the part of the printers, this Company's declaration was referred to on p. 453 of last week's "JOURNAL" as having been made by the Brentford Gas Company. The Brentford Company declared their calorific value as 460 B.Th.U. nearly a year ago.—ED. "G.J."]

Chippenham Gas Company.—510 B.Th.U. (May 15.)
Melksham Gas Company.—500 B.Th.U. (March 1.)
South Oxfordshire Water and Gas Company.—320 B.Th.U. (May 22.)
Spenborough Urban District Council.—450 B.Th.U. (June 1.)
Weymouth Consumers' Gas Company.—460 B.Th.U. (March 31.)

GAS REGULATION ACT ORDERS.

We have received from the Director of Gas Administration copies of the following further Orders made by the Board of Trade under section 1 of the Gas Regulation Act.

Bognor Gas Light and Coke Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 17d. per therm, and this price shall be substituted for the price of 4s. 1d. per 1000 c.ft. mentioned in section 51 (dividends dependent on price charged) of the Bognor Gas Light and Coke Company Act, 1908.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-three-quarters.

After the declared date, "1·2d. per therm" shall be substituted for "6d. per 1000 c.ft." where "6d." secondly occurs; and "0·6d." shall be substituted for "3d." in the third proviso to section 51 of the Bognor Gas Light and Coke Company Act, 1908.

After the declared date, the prices of 16·6d. per therm and 17d. per therm respectively shall be substituted for the prices of 3s. 11d. and 4s. 1d. per 1000 c.ft. mentioned in section 52 (limit of price for gas for public lighting) of the Bognor Gas Light and Coke Company Act, 1908.

Prepayment meter clauses are included. (Feb. 22.)

Crossgates, Halton, and Seacroft Gas Company, Ltd.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 13d. per therm.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by five-and-four-fifths. (Feb. 18.)

Farnham Gas and Electricity Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 14·4d. per therm.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by five.

Prepayment meter clauses are included. (Feb. 22.)

Hayward's Heath District Gas Company.

After the declared date: (1) The standard price in respect of gas supplied by the undertakers shall be 18·4d. per therm; (2) "1·2d. per therm" shall be substituted for "6d. per 1000 c.ft.," and "2·4d. per therm" shall be substituted for "1s. per 1000 c.ft." in paragraph (B) of sub-section (2) of section 28 (price of gas) of the Hayward's Heath Gas Act, 1914.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by four-and-one-quarter.

After the declared date, "0·1d. per therm" shall be substituted for "½d. per 1000 c.ft." in sub-section (1) of section 26 (power to establish a benefit fund) of the Hayward's Heath Gas Act, 1914.

Prepayment meter clauses are included. (Feb. 18.)

Lymington Gas and Coke Company, Ltd.

As from the declared date, the maximum price in respect of gas supplied by the undertakers shall be 17·2d. per therm; and this price shall be substituted for the price of 5s. per 1000 c.ft. wherever it occurs in section 24 (price of gas) of the Lymington Gas Order, 1900.

As from the declared date, the word "therm" shall be substituted for the words "1000 c.ft.," and the words "fifth of a penny" shall be substituted for the word "penny" wherever it occurs in paragraph (2) of the third schedule to the Lymington Gas Order, 1900. (Feb. 17)

Melksham Gas Light and Coke Company, Ltd.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 16·8d. per therm.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by five. (Feb. 8.)

Otley Gas Company.

After the declared date, the standard price in respect of gas supplied by the undertakers shall be 13·6d. per therm.

For the purpose of ascertaining the authorized rate of dividend, any price charged per 1000 c.ft. before the declared date shall be rendered into the equivalent price per therm by dividing it by five-and-four-fifths.

After the declared date, "1·2d." shall be substituted for "6d.," and "therm" shall be substituted for "1000 c.ft." wherever they occur in section 73 (price of gas to the Otley District Council) of the Otley Gas Act, 1901. (Feb. 21.)

Sheppy Gas Company.

As from the declared date, the maximum prices in respect of gas supplied by the undertakers shall be 18·2d. and 25·4d. per therm; and these prices respectively shall be substituted for the prices of 4s. 6d. and 7s. 6d. per 1000 c.ft. mentioned in section 83 (price of gas) of the Sheppy Gas Act, 1871.

As from the declared date, the word "therm" shall be substituted for "1000 c.ft." wherever this occurs in section 68 (supply of gas to public lamps) of the Sheppy Gas Act, 1871. (Feb. 22.)

Walker and Wallsend Union Gas Company.

It was reported at the annual meeting of the Company that the revenue for the year ended Dec. 31 was £122,027, and the expenditure £117,923, leaving a balance of £4104 as profit for the year. Adding the balance of undivided profit brought forward £4418, and a sum of £6961 from the insurance fund, there was a total of £15,483. Interest on mortgages, &c., called for £4958; and the preference dividend for £1422. Interim dividends were paid of 1¾ p.ct. on the ordinary 3½ p.ct. stock, and 2½ p.ct. on the ordinary 5 p.ct. stock; and the Directors recommended final dividends of 2¾ p.ct. on the 3½ p.ct. stock and of 3½ p.ct. on the ordinary 5 p.ct. stock—all less income-tax. This would leave a balance to be carried forward of £4026. The Directors stated that the revenue account for the year showed a decrease in the receipts as compared with the previous year of £13,197, and in the expenditure of £14,353. Owing to the loss occasioned by the ill-advised miners' strike, it had been necessary to appropriate the sum of £6961 from the insurance fund account. The effect of the strike, together with the general depression in trade, had led to a diminished output of gas for the year. As indicated in last year's report, the price of gas was raised as from Feb. 28, 1921, to 5s. 6d. per 1000 c.ft., which augmented the sales receipts for the year. On the other hand, the receipts from residuals were adversely affected all round. The present more favourable price of coal pointed to consideration being given to an early reduction in the price of gas. The applications of the Company for Orders under sections 1 and 10 of the Gas Regulation Act had been granted by the Board of Trade. The new standard price granted was 14·8d. per therm, with a modification of the sliding-scale. Since June 27 last, the Company had charged 13·2d. per therm, and were enabled to pay the dividends recommended for the year. The Order under section 10 conferred additional capital and other powers.

COMMERCIAL GAS COMPANY.

The Annual Ordinary Meeting was held last Thursday, at the Cannon Street, Hotel, E.C.—Mr. W. G. BRADSHAW, C.B.E., in the chair.

The SECRETARY (Mr. F. J. Bradfield) read the notice convening the meeting; and the Directors' report and the statement of accounts were taken as read.

THE THERM ORDER.

The CHAIRMAN, in moving that the report and accounts be received and adopted, said: Gentlemen,—When we met you here in February, 1921, we were waiting for the issue by the Board of Trade of the Order fixing the standard price per therm and the standard dividend of this Company under the Gas Regulation Act, 1920. The Order was at length duly received by us, and came into operation on April 1. It is fully set out in the printed report of the Directors; and I will not weary you by repeating it. But I may say that, while we did not obtain all that we thought we were justified in asking from the Board of Trade, we have no reason to complain that we were otherwise than fairly treated; and I think that over a series of years, as the high cost of materials and wages is modified, the shareholders may anticipate a fair return upon the capital invested in the undertaking. When we received the Order, we confidently expected that we should be in a position to recommend to you the payment of dividends for 1921 of at least the pre-war rate.

EFFECTS OF THE COAL STRIKE.

Looking back, we can see that our anticipations were fully warranted, and would have been realized, had it not been for the disastrous strike of the coal miners which, as you are aware, lasted from April 1 to the end of June, and inflicted irreparable damage upon all classes of the community, including the miners themselves. It is not my province to enter into the merits of the strike, nor is it necessary to recall the objects, avowed or secret, for which it was undertaken; but it is my duty to comment briefly upon the adverse effects it exercised upon the operations of the Company. Soon after the commencement of the year, we had to face, and deal with, a collapse in the value of our residual products, which resulted mainly from the sudden cessation of the demand from abroad. This difficulty had to be met by an increase in the price of gas, the necessity for which we regretted; but it would have inflicted no great hardship upon our consumers, or the shareholders, had it not been for the strike. The commencement of the strike on April 1 found us with a good stock of coal; but, as the duration of the strike became increasingly uncertain, and our ships were lying idle, we were forced to buy large quantities of French and German coal of a very inferior quality at exorbitant prices. In this Company's case, purchases were made of Brouay and Saar coal, varying in price from 50s. to 82s. 6d. per ton f.o.b. in some French or Belgian port, where great delays took place, resulting in further loss. When you contrast these prices with the average price of coal f.o.b. in the Tyne immediately prior to the strike which was 35s. 7d. per ton, and bear in mind that this foreign coal was not worth half as much as the value of our English coal, you will get some idea of the enormous damage the gas industry and the country at large suffered through the strike. We lost at least £60,000 directly; and a much larger sum when diminution of business, loss of residuals, extra labour involved in handling the bad coal, and other ill-effects are taken into account. I need not remind you that five-sixths of the total loss whatever it was fell upon the consumers, the majority of whom in our district are working-class people and tradesmen.

PRICE OF GAS AND THE STRIKE.

We felt it right that the whole cost of the strike should be paid for in the year in which it occurred, because the consumers, although they suffered from the extra cost of the gas, yet benefited enormously by having a reliable fuel brought to their houses during the strike when other forms of fuel were much dearer, and were almost unobtainable. Moreover, it did not appear to us necessary that any part of the burden should be imposed on consumers of a subsequent year who might not, and in some cases would not, be the same people as those who derived advantage from the supply of gas in the time of difficulty. To recoup the loss, the price of gas was raised to 1s. 3d. per therm—equal to 5s. 11½d. per 1000 c.ft.—as from Midsummer; and, as you will see when I comment on the revenue account, this increase in price was barely sufficient to meet the extra expense. A satisfactory feature was that our engineering staff succeeded in keeping up the supply without much diminution of pressure, and with little deterioration of quality. This is greatly to their credit, for they had many difficulties to surmount.

THE OTHER SIDE OF THE STRIKE PICTURE.

A bright side to the otherwise dark picture is the firmness displayed by the Government in refusing to allow one section of the community—and perhaps only the extremists of that section—to dominate and impose its will upon the whole country. It may well be that the reasonableness since shown by labour all over the country, with regard to the necessary wage reductions in all industries, is the direct outcome of the country's determination and patience in what was a most anxious and trying period. The improved output of coal since the resumption of work has also greatly assisted in bringing down the cost; and these savings in wages and cost of coal, or at least a part of them, probably would not have been effected had there been no lesson taught by the coal strike. Another satisfactory result of the strike, from the point of view of the gas industry, is that the enormous value of gas to the community in times of national emergency has once more been effectively demonstrated; and it is no exaggeration to say that the industry as a whole has emerged from the ordeal with an enhanced reputation in the eyes of the public.

THE POSITION AS SHOWN BY THE ACCOUNTS.

I will now briefly comment upon the accounts for the year which are before you, because they will most clearly demonstrate the position and prospects of the Company. If you will look at the capital account, you will see that we spent last year £33,107, of which £31,058 was expended on new plant. We have very considerably improved our coal-gas manufacturing plant at Stepney and Poplar. The work is now practically completed; and there will not be any more expenditure on this head for some time to come, unless trade revives, and our business is thereby very much extended. The result of this will be that the depreciation of ships, stoves, and prepayment meters, will make itself felt, and will gradually reduce the balance of capital expended beyond the amount raised. On the revenue account the abnormal circumstances of last year almost preclude the usefulness of any comparison with the figures of the previous year; but I might point out that coals cost more by £15,667, and oil less by £20,918. On the other hand, repairs were less by £89,522. The figure in the revenue account covers all repairs and renewals, which were immediately required; but it was obviously not desirable under the conditions brought about by the coal strike, to burden the revenue account more than was necessary. Residuals produced less by £140,729, for reasons which I have explained. The adverse factor with which all gas companies had to contend last year was the combination of the high cost of coal and the low price obtained for residual products. The following table will exemplify this statement:

	Half Year June, 1914.	Year 1920.	Year 1921.
Coals per ton	17 8	43 3	48 6
Residual products per ton of coal	10 10	36 10	27 4
Net cost of coal per ton	6 10	6 5	21 2

These figures show that the cost of coal last year was 5s. 3d. per ton more than in 1920, and 30s. 10d. more than in 1914; while residuals produced less than last year by 9s. 6d. per ton of coal carbonized. The result is that the net cost of coal was 21s. 2d. last year against 6s. 5d. in 1920—a difference of 14s 9d. On the other side of the account, gas, owing to the higher price, and in spite of the smaller quantity sold, returned £115,352 more. The balance of profit carried to the net revenue account was more by £49,256. The payment of interest on the debenture stock and temporary loan and dividends at the rate of £4 5s. 4d. and £3 16s. 8d. p.ct. on the two classes of ordinary stock will absorb £118,756, which is £1770 more than was earned. Consequently, the sum of £26,700 undivided profit which we brought forward from 1920 is carried forward into 1922 at the diminished figure of £24,929. When I tell you that the balance of profit for the first half of the year was only £4178, I think you will consider that the final result may rightly be regarded as satisfactory.

DECREASE IN SALES OF GAS.

The most serious point on the accounts is the decrease in the sales of gas of 8·39 p.ct., which represents 329 million c.ft. That is due to the poorness of trade, the falling-off of manufactures in our district, and to all classes of consumers having less money to spend. Every gas company in London and the suburbs had decreased sales, except the South Metropolitan Company, who had a small increase of ½ p.ct.; but our decrease was by far the largest as might be expected from the character of the district which we supply. The large accounts of gas sold for use in gas-engines show a reduction of no less than 27·11 p.ct. Large trade accounts are less by 20·75 p.ct., and large users of gas for general purposes took less gas by 13·5 p.ct. The smaller ordinary accounts show a reduction of only 11·78 p.ct. and prepayment meters of 4·14 p.ct. It is satisfactory to know that our smaller business is not due to loss of customers, but to the fact that, owing to bad trade, unemployment, and heavy taxation, they have not been able to afford to purchase so much gas. That we have not lost customers, and have increased rather than less potential earning power, is proved by the fact that we have considerably more ordinary meters and more stoves on hire, and only a few less prepayment meters on the district. As soon then as trade improves, we may look forward to a larger sale of gas and increased profits. Of course, we cannot hide from ourselves the consideration that the high price of gas must have an adverse effect on the sale of it; and we must one and all exert ourselves to the utmost to maintain as cheap and efficient a supply as circumstances permit. There is not a single person connected with the Company—either as Director, or member of the staff, or workman—who cannot do something towards the attainment of this most desirable object.

FAVOURABLE FEATURES AND A REDUCTION OF PRICE.

There are favourable features about the present position which make the future full of promise. The cost of coal and other materials is falling, and has been falling for some months. The charge for wages and salaries is being reduced as the cost of living gets less. We have already been able to reduce the price of gas as from the beginning of this year from 15d. to 13d. per therm, which means 9½d. per 1000 c.ft., and a saving of £142,000 per annum to the consumers, with a proportionate increase in the shareholders' dividend and the employees' bonus. I hope that this reduction is the prelude to another decrease in the price before long.

ECONOMY OF PRODUCTION THE NEED.

The first need of the Company, as of every industry in the country, is economy of production, and that can only be attained by a rigid carefulness in expenditure, and by everyone giving his best and doing his utmost for the concern in which he is employed. The greatest enemy the workmen of this country have to face at the present time is the mistaken idea that restriction of output leads to the employment of more men. It may do so for a short time in some cases; but it inevitably leads to higher cost of production, and so to smaller sales and loss of trade, and ultimately, as markets are closed against us, to the shutting-down of factories and greater unemployment. Our home trade is dependent on our foreign trade; and it stands to reason that we shall never be able to compete with other nations in the markets of the world until we can bring our cost of production to the level of or below theirs, and manufacture a better and more attractive article than they. We have done this before; and we can do it again. But

it necessitates much self-denial on the part of all engaged in the industries and manufactures of the country, and harmonious co-operation between capital and labour. I think that you may rest assured that such co-operation and such strenuous endeavours will not be wanting in this Company; for our relationship with our workmen is all that can be desired, and they are fully aware that their welfare is bound up with the prosperity of the concern. The results we place before you to-day, moderate as they undoubtedly are, could not have been obtained without much good work on the part of all the staff.

CARBON MONOXIDE.

There is one other matter to which I must allude before I sit down. A good deal of uneasiness has been caused by reports which have appeared in the public press of the dangers of carbon monoxide, which is one of the constituents of carburetted water gas. These reports are based upon accidents which have occurred in America where the use of water gas unmixed with coal gas is permitted. Pure water gas is, I believe, almost odourless, and, being poisonous, the use of it alone would be highly dangerous. But in this country it is always mixed with coal gas, which has a very pungent smell, and an escape is therefore easily detected. The Governor of the Gas Light and Coke Company pointed out in his address to his shareholders a few days ago that fatal accidents in this country to consumers of gas are only 2 per annum per million of the population, while fatalities due to railways are 22 per annum per million, and to street accidents in London 100 per annum per million. A Committee of experts appointed by the Board of Trade have already investigated the question, and decided that no restriction in the percentage of carbon monoxide in gas is necessary. The Board of Trade recently lodged the draft of a Special Order for the approval of both Houses of Parliament (which has now been given), providing that "no gas undertakings as defined by the Gas Regulation Act, 1920, shall supply any gas for domestic purposes containing carbon monoxide unless such gas possesses the distinctive pungent smell of coal gas." We are entirely in accord with this proposed regulation—in fact, I do not know of any gas undertaking in Great Britain which violates it or desires to do so. The public may rest assured that coal gas either with or without an admixture of carburetted water gas, with ordinary care, is a perfectly safe fuel and illuminant.

THE PROSPECTS.

As regards the prospects before us, we are not living in times when it is easy or safe to prophesy; but if there should happily be an absence of disturbances in the sphere of labour, and if the cost of coal and other materials and wages continues to fall, we may look forward to being able to lower the price of gas. This means that the employees will receive a better bonus under the profit-sharing scheme and the shareholders will find their dividends improving, and the market value of their holdings of the Company's stock appreciating.

The DEPUTY-CHAIRMAN (Mr. H. E. Jones) said the Chairman's speech had been so lucid and exhaustive that he would merely, with the greatest pleasure, second the motion.

Mr. T. JACKSON called attention to two or three matters that were of a purely administrative character connected with the Company's business dealings with the Working Lads' Institute, Whitechapel.

The CHAIRMAN promised that he would give personal attention to the various points raised.

The motion was unanimously carried.

THE DIVIDENDS.

The CHAIRMAN moved the declaration of dividends for the second half of the year at the rates of £4 5s. 4d. p.ct. per annum on the 4 p.ct. stock, and £3 16s. 8d. p.ct. per annum on the 3½ p.ct. stock, both less income-tax. He remarked that, though the meeting was being held a little later this year than usual, they were paying the dividend earlier than the other companies, so that the proprietors were not suffering in this respect from the delay.

The DEPUTY-CHAIRMAN seconded the motion, which was unanimously carried.

RETIRING DIRECTORS AND AUDITOR.

The CHAIRMAN moved the re-election of Mr. H. D. Ellis and Mr. H. W. Gell, the two Directors retiring by rotation. He remarked that as "good wine needs no bush," he would not say anything about his two colleagues, excepting that Mr. Ellis had been with them for many years. His value to the Company continued to increase with advancing years. In Mr. Gell they had a gentleman of great business capacity, who helped the Board very much in the conduct of the business.

The DEPUTY-CHAIRMAN seconded the motion, which was cordially adopted.

Mr. GELL, on behalf of Mr. Ellis and himself, said they were much indebted to the proprietors for this further expression of their confidence. He hoped that their renewed period of service would be of less anxiety to themselves and more prosperous for the Company than the period of service they had just concluded.

On the proposition of Mr. O. C. HILLS, seconded by Mr. W. GROVES, the retiring Auditor (Mr. S. W. Savage) was reappointed.

VOTES OF THANKS.

On the motion of Mr. FRANK JONES, seconded by Mr. S. M. WOOD, a vote of thanks was passed to the Chairman and Directors, the staff, and the workmen for their services during the past year.

The CHAIRMAN, on behalf of his colleagues and himself, begged to thank the proprietors very much for the cordial way they had received the proposition, and the mover and seconder for the more than kind expressions they had used in proposing it. It was a great pleasure to serve the Commercial Gas Company. He had known it intimately all his life. He believed the Company were entering upon a time of still greater prosperity; and he hoped he would never have to move a resolution recommending so small a dividend as he had had to do that day. He looked forward to the time when their dividends might increase by a moderate amount. He would leave Mr. Stanley Jones and Mr. Bradfield to reply on their own behalf. But he (as Chairman) would like to say that they had had an extremely arduous time the last year; and there had never been an occasion when they had deserved more the vote of thanks that had been so kindly accorded to them. The seconder of the resolution asked a question as to the capital account. It was overdrawn by nearly £118,000; but if the proprietors would look at the other side of the account, they would see their depreciations were beginning to tell. They did not want to go into the market, and load the concern with further capital, so long as it could be avoided.

Mr. STANLEY H. JONES (Engineer and General Manager), on behalf of the engineering and managerial staff, thanked the proprietors very much for their kind vote. They had had a strenuous year; but they had come through better than they might have expected to do. During the coal strike, there were bright gleams in spite of the anxieties; and one of them was the readiness with which the Company's workmen stuck to their jobs. There were attempts to seduce them from their allegiance to the Company; but they failed. One of the most gratifying directions in which the men showed their loyalty to the Company was in the sea staff. They had to send their steamers to the coast of France; and he might say the sailors were like sand boys. They were glad to get off and do something. In every direction, the workmen backed-up their officers properly during the strike.

Mr. BRADFIELD, on behalf of his staff and himself, thanked the proprietors for this renewal of their confidence. As Mr. Jones had said, they had had their trying times. As to the clerical staff, they were exceedingly loyal and determined to do their duty always. They appreciated greatly what the Board had done by way of increased remuneration, or war bonus, during the period of the high cost of living. Realizing they now had to part with some of the extra pay, they were accepting the position willingly, and in the same spirit as the men were accepting it. They were determined to carry on and do their duty as they had always done.

LIVERPOOL GAS COMPANY.

Cost of the Coal Strike.

The Annual Meeting of the Company was held last Wednesday, in the Offices, Duke Street, Liverpool—Mr. H. WADE DEACON (the Chairman) presiding.

The CHAIRMAN, in moving the adoption of the report and accounts, made reference to the retirement of Mr. Allan H. Bright from the Board. He had been a Director of the Company for 25 years, and had always taken a keen interest in its welfare. His advice, especially in financial matters, was of much value; and they would miss him as a useful and valued colleague. In his place, the Directors had appointed Mr. J. Heron Eccles. The Company had passed through another very trying and difficult year; but taking the accounts as a whole, the proprietors would agree that they might be regarded as satisfactory. There were two outstanding factors which had affected the results adversely. One was the great fall in the prices of tar and sulphate of ammonia, and the other was the prolonged coal strike. The strike began on April 1 and extended to the end of June; and it was well on towards the end of July before normal deliveries were resumed. Like all gas undertakings, they were obliged to obtain supplies of such coal as they could, and where they could. Some of this foreign coal was of extremely poor quality, and very high in price. The total cost of the strike to the Company was at least £80,000; and he hoped they would never again have to live through such a disastrous time. Since the end of the year they had issued the £600,000 of redeemable preference stock authorized at the last annual meeting. The issue was successfully carried out; and the amount offered was subscribed four times over. The stock was a 7 p.ct. one. It was redeemable at the Company's option after a period of ten years, and was to be redeemed in any event after twenty years. The issue of this stock entitled the Company to raise a further £200,000 of debentures or mortgages, as occasion arose. The Company had spent on new buildings, plant, &c., a sum of £216,199, the largest part of which had been spen at Garston on entirely new coal-gas plant. They had expected this plant to be ready for operating last autumn; but owing partly to the coal strike and partly to delay in obtaining materials, it was only now that the plant was nearing completion. The cost of manufacture increased from £1,483,378 in 1920 to £1,546,967 in 1921. The increase in the cost of coal and oil was £105,870, against which there were decreases in repairs of £34,682, and wages and two other items of £7599 (net) bringing the net increase in the cost of manufacture to £63,589. There were increases in distribution, management, and special charges; and the total expenditure was £1,827,956, against a total of £1,741,277 in 1920—an increase of £86,679. Sales of gas showed an increase of £209,374. This arose wholly from an increase in the price charged. During the first six months of the year the price was 4s. 5d. per 1000 c.ft.; and during the second half the Directors were forced to increase it to the equivalent of 5s. 1¾d. He said the equivalent of 5s. 1¾d., because the price actually charged was 13d. per therm. The Company had declared a calorific value of 475 B.Th.U.; and the Order of the Board of Trade fixed a price of 12·4d. per therm as equivalent to the standard price under their Special Act of 2s. 1d. per 1000 c.ft. In the Special Act there was a neutral zone between 2s. 1d. and 2s. 4d. per 1000 c.ft.; and similarly in the existing Order there was a neutral zone between 12·4d. and 13d. per therm. The net result was that, so long as the price of gas did not exceed 13d. per therm, they were entitled to pay a standard dividend of 5 p.ct. on their ordinary stock; and when the price was above 13d. or below 12·4d. per therm, the sliding-scale came into operation. When the price was above 13d. per therm, they had to reduce the dividend by 2s. 6d. p.ct. for each 2d.; and when it was below 12·4d. per therm, they were entitled to increase the dividend in the same ratio. The fall in the price of residual products had been very great. The decrease in the receipts from coke was £30,447, from tar £98,049, from sulphate of ammonia £30,337, and other products £4751—a total decrease of £163,584. Deducing the total expenditure from the income, there was a balance of £106,803, against a corresponding balance last year of £150,511. This balance was carried to net revenue account; and after paying an interim dividend of 1¾ p.ct. for the first half of the year, and making provision for the payment of

a dividend at the standard rate per annum of 5 p.ct. for the second half, there was a balance of £51,106 to carry forward. This was less by £24,060 than last year and, taking into account all circumstances, was satisfactory. With reference to carbon monoxide, so far as their own Company were concerned, it was well known they had supplied a mixed gas for about a quarter-of-a-century; and they were working as they had been in the past. There must always be a certain amount of risk in using gas of any kind; but given ordinary care in seeing that fittings and appliances were kept in order, the risk was remote.

The Directors were very glad to be able to reduce the price of gas from the date of the December reading of the meters; and it was now 11d. per therm. This reduction was equal to 9½d. per 1000 c.ft., incidentally representing 25 p.ct. of the war increases. Put in another way, this meant a reduction of about £250,000 per annum in the amount to be paid for gas by the consumers. They now proposed to introduce a scheme for allowing discounts to large consumers in single premises; and this would come into operation at once. They looked forward with considerable confidence to a further reduction in price of gas at an early date. He expressed appreciation of the excellent work done by the officers of the Company, loyally supported by the staff, both inside and outside the office. During the coal strike their workmen did not fail them; and it was a great satisfaction to the Directors to feel they were so well backed-up by their officers, staff, and men.

The motion was seconded by Mr. ALFRED TYRER (the Deputy-Chairman), and unanimously adopted.

NEWCASTLE AND GATESHEAD GAS COMPANY.

Another Reduction Foreshadowed.

The Annual Meeting of the Company was held at the Offices, in Grainger Street West, Newcastle-upon-Tyne, on Tuesday of last week—Mr. JOHN E. COWEN (the Chairman) presiding.

The CHAIRMAN, in moving the adoption of the report and accounts, said there had been a net addition of £75,308 to the capital expenditure, making the account £107,275 overspent. Owing to the more favourable money position, the Directors were considering the advisability of issuing the £70,000 balance of 5 p.ct. redeemable debenture stock. Though they had carbonized 34,000 tons of coal less than in the preceding year, there was only a reduction in the cost of £7800. Wages cost £294,000, compared with £310,000 in 1920—a reduction of £16,000, partly due to the reduced demand for gas. The rates of wages were coming down, but at the present time were still on the average about 120 p.ct. above pre-war. In regard to receipts, gas showed an increase of £273,000 on 1920. In considering this, it must be remembered that the receipts for 1920 showed a reduction of £50,000 as against 1919. There had been a decrease in the sales of gas of practically 9 p.ct.; the reduced sales being due to slackness of trade, the high cost of gas, and general economy on the part of the public. Residuals showed a decrease of no less than £435,000 upon 1920, which year showed an increase upon 1919 of £355,000. The miners' dispute was a trying time; but the Company were able to maintain the supply of gas throughout the period. The estimated loss to the Company was over £50,000. Fortunately, they had a very large stock of coke, which was of the greatest benefit to the inhabitants of the district, and was the means of providing fuel to thousands of houses which would otherwise have been without fires. Moreover, they supplied coke to many towns outside their own area—even as far as Carlisle and Scotland. They did not increase their price during the time of the dispute, notwithstanding the demand; and they had since reduced it. Out of the Company's stocks of coal, on more than one occasion, supplies were sent to the depôts in Newcastle for household use, when otherwise the city would have been entirely without coal. This resulted in the Company's having, before the end of the dispute, to buy more foreign coal at exorbitant prices than otherwise would have been necessary. With regard to the price of gas, during the whole of the war period and right up to May, 1921, the price of the Company's gas never exceeded 3s. 4d. per 1000 c.ft. gross—an increase of 60 p.ct. upon the pre-war price. From July to December, 1920, owing to the high prices received for residuals, they were able to reduce the charge to 2s. 6d., which was only 20 p.ct. above the pre-war figure; and in the autumn of 1920, they were considering how much further the price could be lowered. The great collapse of the residual markets occurred at the beginning of that winter, with the result that, instead of decreasing the price, they had to raise it again to the maximum they were then allowed to charge—3s. 4d. per 1000 c.ft.; and during the early months of 1921, even at that price, they were losing about £1000 a day. They therefore made application to the Board of Trade for an Order to enable them to increase the maximum price. They obtained an Order at the end of April; but by then the miners' dispute had already run a month, and still further loss was being incurred. It was, therefore, absolutely essential that they should immediately increase the price; and this they did as from the beginning of May. Unfortunately, at the same time it became compulsory upon them, under the Order, to charge on the basis of therms. Many people appeared to think that the increase in the amount of their gas accounts was due to charging by therms. This was a fallacy, because it was quite clear that it would have been necessary to increase the price of gas to the same extent if the charge had continued on the volumetric basis. Owing to their obtaining coal in the later months of the year at lower prices, and to reductions in wages, they were able to reduce the price of gas as from December last by 1d. per therm (4⅔d. per 1000 c.ft.); and, after making very careful estimates with a view to further reduction as large as possible, and as quickly as possible, the Directors had decided to reduce the price by a further 2d. per therm (9½d. per 1000 c.ft.) from the meter readings next month. This would make a total reduction of 3d. per therm, or 1s. 2¼d. per 1000 c.ft., since December. The Directors were taking some risks in making so large a reduction at the present moment; but they felt that it was essential to get the price of gas down as rapidly as possible, in the interests of trade generally, in the interests of the shareholders, and particularly in the interests of the consumers. In this connection, it was to be remembered that it was only by lowering the price of gas that a higher dividend could be paid. He trusted that circumstances during the current year might enable them to pay the shareholders a more just and equitable dividend for the use of their money than they had been able to do during the past few years.

After the adoption of the report and accounts, a resolution was passed agreeing to the payment of final dividends of 2 p.ct. on the preference stock, making 4 p ct. for the year; and of £2 5s. p.ct. on the ordinary stock, making £3 15s. p.ct. for the year.

PORTSEA ISLAND GAS LIGHT COMPANY.

Reduction in Price.

The Half-Yearly Meeting of the Company was held on Thursday last—Mr. T. H. F. LAPTHORN, J.P. (the Chairman), presiding.

The CHAIRMAN, in moving the adoption of the report and balance-sheet, dealing first with the capital account, said they had spent during the half year a sum of £15,154, of which £11,892 had been for the new plant at Hillsea. This plant was already finished, and was working well. They had spent £73,000 towards the cost, and had a balance of about £10,000 to find. It was a tribute to the care which Mr. Carmichael had shown in drawing out the original plans and specifications, and the attention he had exercised in supervising the work, that unlike so many contracts the actual cost had worked-out at less than the original estimate. The estimate was about £93,000, and they would see the end of the job at about £83,000. In "Field's Analysis" the accounts of 31 of the largest gas undertakings of the country were closely analyzed and examined; and it showed that the capital expenditure of this Company, in proportion to the quantity of gas sold, was among the lowest. This was due to the fact, as the records of the Company showed, that it had ever been the consistent policy of the Directors to watch the expenditure carefully and to keep the capital account as low as possible. The benefit to the consumers was obvious, because, with small capital and dividends limited by Act of Parliament, there was all the more money available to go towards the reduction in the price. Turning to the revenue account, they had spent in coal and oil £28,504 less; but the average price of coal, as distinct from oil, was 2d. per ton more than in the corresponding half of the previous year. The explanation was that they had made less gas, and therefore used less coal, and had consequently used more oil, in which there had been a considerable fall in price. But the net cost of their fuel had risen by £4395, due to a heavy fall in the price of residuals. Rates were up to the extent of £757, and, compared with 1913, they were paying in rates now nearly £4000 more than they paid then. The receipts showed an increase from private consumers of £2500, due entirely to the increased price of gas. There had been a fall in the sales equal to 39 million c.ft., or 4·11 p.ct. The reasons for this fall were pretty well known. Last half year they had an exceedingly mild season, and coupled with this was a serious trade depression. In this respect their experience had been that of practically every other company in the country, and in many cases the fall had been greater than in theirs. But there was a tendency to use gas for industrial and cooking purposes in so many new directions that they might confidently expect that, as things became normal, they would see a considerable increase in their sales in the future. Referring to the sale of residual products, during the half year these had fallen from £98,000 to £58,000, or a fall of £40,082. The sale of coke gave them £26,312, compared with £52,326 twelve months ago, or a drop of one-half. This was due to the fact that, having made less gas, they had used less coal, and that the coal which they had to use during the strike period was of an inferior quality and yielded less coke, and, further, the price of coke fell by more than 10s. a ton. Breeze yielded £2202, as against £3899—there again a fall of nearly 50 p.ct. The sale of ammoniacal liquor and sulphate of ammonia showed a yet more remarkable result. Whereas twelve months ago they made a profit of £6447, in the last six months they showed a profit of only £85. There was such a slump in the market that it paid them better to run the liquor to waste than to incur the expense of conversion. The result of six months had been that they had made a trading profit of £31,373, which would enable them, after paying the interest on their loan account, and after paying income-tax and making the usual transfer of £2258 to reserve, to pay dividends at the rate of £12 10s. p.ct. per annum on the "A" and "B" shares; £11 10s. on the "C" shares; £9 10s. on the "D" and "E" shares; and 5 p.ct. on the 5 p.ct. (maximum) stock, carrying forward £13 954—a sum still appreciably below their pre-war carry-forward; but still they were gradually overtaking the pre-war figure. It would be seen that the Board recommended an increase in the dividends all round of ½ p.ct. This increased payment in the form of dividend would take the sum of only £804, and divided by 1000 shareholders, the share of each would not be excessive. On the subject of carbon monoxide, he said Portsmouth people had nothing to complain of, because the Corporation tests had shown that the public had no ground whatever for either complaint or fear. He then went on to announce a reduction in price equal to £45,000 a year, and with the reduction made last November equal to £68,000. Other reductions made to large consumers would amount to something like £3000 per year, so that during the last four months the savings they had effected to consumers would amount to over £70,000 per year. They owed it to the public to get the price down as quickly as possible; and had it not been for the tremendous slump in residuals, they could have made it appreciably more than 6d. per 1000 c.ft. He closed with a cordial appreciation of the work of the staff; Mr. Carmichael (the Engineer) and Mr. Stibbs (the Secretary) being specially mentioned, because upon them had fallen the heaviest responsibility.

The report and accounts were adopted without discussion.

Belfast Lighting.—The estimates for the current year approved by the Belfast Corporation provide £60,150 for street lighting. It was decided by the Council that the usual contribution of £11,460 from the profits of the gas undertaking be made for payment of interest and sinking fund on the cost of the City Hall.

HORNSEY GAS COMPANY.

The Chairman on the Policy of Cheaper Gas.

The Half-Yearly Ordinary General Meeting of the Company was held last Friday, at No. 5, Great Winchester Street, E.C.—Mr. A. M. Paddon (the Chairman) presiding.

The Secretary (Mr. W. E. Roberts) read the notice convening the meeting; and the report and accounts were taken as read.

The Chairman, in moving the adoption of the report and accounts, said he did not think they would be submitted in the same form on future occasions, because half-yearly meetings were now becoming increasingly few; and in the ordinary course of things the next general meeting of the Company would be an annual one—thus bringing them into conformity with modern practice in this regard. The Order to enable them to do this was now under consideration; and in due course the change would take place.

A LOW CAPITAL EXPENDITURE.

Dealing with the statement now submitted, he thought he could put the position of the Company before the proprietors in its more important aspect in a very few words. It would be advisable just to consider briefly these outstanding matters, if they were not to meet again for another twelve months. Taking first the statement of capital stock, it would be found that they had powers unexhausted of issuing capital to the extent of £120,500; and in regard to loan capital they had unexploited powers amounting to £34,500. These taken together, in connection with the facilities which the Government would afford them, if necessary, in their issue, were ample for all the requirements of the Company so far as they could be foreseen at the present time. They did not anticipate being committed to any very large capital expenditure, because their works were in good order. They were up-to-date, and with some enlargements now in progress would be amply sufficient for all they could foresee as likely to come upon them. Going to the capital account, it would be seen that the total expenditure of the Company was £259,504; and this was equal to the remarkably low figure of £394 per million c.ft. of gas. It would, perhaps, be a little more accurate if they based this figure upon the capital received, rather than upon the total expended; but even in that case, it would only result in an almost equally low figure being disclosed, in the vicinity of £420 per million c.ft. Now, £420 per million c.ft. to-day was very different from (say) six years ago. In regard to most undertakings the capital account had gone up by leaps and bounds, simply because the cost of work had been doubled, and some two years ago trebled; and where companies had had to carry it out, they had incurred a very large disbursement of capital, which had its burden in interest and dividend. As a matter of fact, their Company had only spent £30 of capital in the last six months; and they could hardly have done less than this. When such a low figure of capital as this was associated with a certain cash balance at the end of the accounts, it would be realized that every penny the Company had raised was working hard for the shareholders, and that there was no capital that was derelict or was failing to contribute as earning power to the profits of the Company. This was an important point to consider. Turning to the revenue account, there was not much to be commented upon. The sale of gas in the six months had only brought them in just over £600 more than in the corresponding period of the previous year; but in respect of residuals they had lost nearly £10,000 by comparison in the half year under review. This was inevitable; and having regard to the state of markets, they could not possibly help it. But when they looked at the other side of the account, as against this £9000 they had saved in economies and in disparities of costs over £12,000; so that they had re-established their position amply by their trading account. The profit, at £9208, was nearly £2000 more than before.

A SOUND BALANCE-SHEET.

Now, the proprietors would naturally be anxious to know—interested as most of them doubtless were in gas administration finance—whether the balance-sheet which provided a profit like this was sound in the provision made for the maintenance of the efficiency of the undertaking. On this, he could at once assure them that it was a thoroughly sound statement. Every possible provision had been made which contributed to efficiency and to the maintenance of the full technical value of the Company's plant. This profit was only struck when every possible provision had been made in regard to the apparatus and undertaking generally. Moreover, there were certain items which showed that they had, if anything, been a little more liberal than they needed to be. For instance, there was the appropriation to the benefit fund. They need not have taken this, on the finances disclosed; but they had done so. Carrying forward the profit to which he had referred, and adding what was brought into the account, *plus* some interest, there was a sum of over £25,000 to deal with. There were certain disbursements shown on the debit side of the profit and loss account; and when the necessary provision had been made for the dividends now recommended, they would carry forward £15,881, or some £227 more than was brought into the account. Thus they had slightly improved their position even in this regard. He was sure they would agree with him that this was a very healthy statement—so healthy that he thought it would be envied by most companies who might compare it with the position of their own undertaking at the present time. To deal briefly with the succeeding accounts, there was £11,262 in the special purposes fund; while the reserve fund amounted to £1612. The latter was obviously small as a comparative figure with other undertakings; but it had an off-set in the fact that the carry-forward, at just under £16,000, was proportionately a large one as compared with other undertakings. They could not very well have it both ways. They hoped to supplement the reserve as it might be convenient to do so, though with the dividends they paid there was not a very large margin; but the necessity of a reserve fund with figures like those he had quoted was not so great as in general circumstances. They had cash in Treasury Bills, on deposit, and at bank amounting to some £22,000, which showed that their financial position was easy, and that they were still provided with ample working capital. If they looked at the amount due to sundry tradesmen and others for coals, stores, &c., they would see that it was exactly balanced on the other side by the gas and meter rental due to the Company, which he believed was, from an accountant's point of view, an ideal state of things.

AN INCREASED SALE OF GAS.

The report had rather more in it than usual, because, if they had not themselves been making history, they had been having it made for them by Government procedure. The report told them that there had been an increase in the sale of gas; and the mere fact that it was an increase was something upon which to congratulate themselves to-day, because, as they knew, the majority of undertakings—and particularly the big ones—recorded a decrease in connection with the recent period of trading. These decreases, of course, were more or less inevitable, when one came to think of all the aftermath of the coal strike and labour disturbances, and the condition of trade generally, from which they were all hopeful that they would soon emerge. During the last half of the past year, this state of affairs reacted upon every form of industry. If in face of all these things they could show an increase in sales, it was extremely gratifying.

THE THERM BASIS.

The report went on to state what the Directors proposed to do in the way of dividend, and disclosed the fact that they were in a position to pay the somewhat ample dividends that were distributed before the war, and with a certain margin in the Company's favour. Then the report told them that the Company had changed the rather empirical form of charge per 1000 c.ft. for the "therm" basis. This new method might at first be a little confusing, and be regarded with some distrust; but when consumers had had a few accounts rendered, and saw just what the change meant, they would be reassured, and would no longer regard the therm with apprehension. Technically the therm was a very great advance, and of the utmost possible value, because it was an absolute comparative medium when one wished to find out what was being done. With the 1000 c.ft. basis one had something which meant one thing in the north and something totally different in the south. But a therm at Dover and a therm at Edinburgh were exactly the same; and therefore something had been achieved in getting a technical basis of comparison of an entirely reliable kind. Thus to those engaged in the administration of gas undertakings it would prove a very great advantage. The Directors had given the prescribed notice as to the calorific value of their gas. They had decided this point upon its merits at the time, and put it at 470 B.Th.U.; but he thought they would find, as general experience in the gas industry went forward, that there would be a tendency to place this calorific value as high as possible. If it should be necessary in the future, they would be able to revise the figure, and to fix upon a higher calorific value. It made not a bit of difference to the consumer, because it had to be reduced to therms; and a therm was a therm. But it would conduce to the more economical operation of gas undertakings if they put the calorific value as high as they possibly could consistent with their methods of manufacture.

THE CHEAPEST GAS IN LONDON.

When the Company made the change to which he had referred, they fixed the price per therm at 11½d., which was very low at the time; and he was gratified to be able to tell them that they had since reduced it still further, and were selling gas to-day in the Hornsey district at 11d. per therm, which was the lowest price at which gas was being sold in the whole London area, taking big and small companies. The only other Company approaching them was their immediate neighbour on the south side. The Hornsey Company could congratulate themselves to-day that, in the race, they had got a little ahead, and that Hornsey had the distinction (which no one would grudge Mr. Buckley, their able Engineer) of selling gas at the lowest price. This question of the price of gas transcended every other in importance to-day. If anyone were to ask him whether he considered the gas industry, at the prices at which gas was now being sold, a sound and stable one, he should reply that he did not. In many directions, there was a tendency to disregard the artificial basis of charge upon which gas undertakings were being carried on at the present time. These high prices were forced upon them by necessity, and sanctioned by the Government; and this would show that they ought to be regarded as temporary, and temporary only, and that they should be resigned at the earliest possible moment. This was not a time to reconstitute the finances of the gas undertakings at the expense of the consumer. It was rather a time to re-establish the most favourable conditions for the consumer, to give him the fullest possible value in what he was buying—if necessary at the expense of the finances of the undertaking. There was already a slight cleavage in this matter of policy. Some very large companies had adopted the stronger policy of re-establishing the business of the gas industry with its consumers upon a low-price basis, even at some little financial sacrifice for the time being; but there was a tendency in the case of other companies to regard these prices as being otherwise than temporary, and to accrete revenue from the consumer. He ventured to think this latter was a most mistaken policy. Every effort should be made, even at some sacrifice, to convince the consumer of the economic value of the article the gas industry supplied. Insistence on a high price while things were in the present disturbed condition would be recorded against the industry; and the consequences in the future would be lamentable, unless the bold, clear, sound policy was taken of bringing the price of gas down to such a point as to make the proposition so attractive to the consumer that he would not be able to resist it. He (the speaker) felt very strongly upon this point. Now, they did not preach from the Directors' side of the table what they failed to practice, because their price of gas was one which gave the consumer every inducement to trade with them and extend his operations, for it made gas bear a most favourable comparison with anything else he could get. For this, the Company would have their reward. They had been getting a large increase in the first part of this year; and he was not without hopes that this state of affairs would be maintained, at any rate in a great degree, until they met again. If that proved to be so, the Directors would have a no less favourable statement to submit than the one presented now—favourable as he had demonstrated it to be.

Mr. A. F. Phillips (the Deputy-Chairman) seconded the motion, which was carried unanimously without discussion.

DIVIDENDS AND RE-ELECTIONS.

The CHAIRMAN next moved: "That the sum of £1645 16s., less income-tax, for the payment of the half-year's interest on £65,832 5 p.ct. preference stock to Dec. 31, 1921, be set apart, and that the same be paid accordingly; and that a dividend at the rate of 12½ p.ct. per annum on the 10 p.ct. "A" stock, and at the rate of 9½ p.ct. per annum on the 7 p ct. consolidated stock for the half year ended Dec. 31, 1921, subject to income-tax, be, and is hereby, declared, payable."

Mr. J. M. MILES seconded the proposition, which was agreed to.

The CHAIRMAN moved the re-election as Directors of Mr. G. W. Carey and Mr. F. H. Jones. He said the presence on the Board of these two gentlemen might be taken as a corollary of the report the Directors had been able to make that day. Directors of gas companies nowadays must have experience and must have skill: and they could not have two Directors who more completely complied with these requirements than did Mr. Carey and Mr. Jones.

Mr. PHILLIPS seconded the motion, which was passed.

On the proposition of Mr. K. R. MACKAY, seconded by Mr. WILLIAM RICHARDS, the retiring Auditor (Mr. H. A Floate) was also re-appointed.

VOTES OF THANKS.

The CHAIRMAN said he had now to propose a hearty vote of thanks to the Engineer and General Manager, the Secretary, and other officers and staff. In effect, he had already done this, because, of course, the results to which he had referred emanated from these gentlemen, and reflected the skill and assiduity with which they discharged their respective offices. Mr. Buckley was not only selling the lowest priced gas in London, but it was good gas. In his department there was not one single detail of the service he rendered which was not eminently satisfactory to the Directors, and therefore to the proprietors. With regard to the Secretary, his duties had of recent years been more onerous; but Mr. Roberts had fully responded to every demand that had been made upon him. These gentlemen would, he was sure, say just the same thing of their staffs.

Mr. F. H. JONES, in seconding, remarked that he agreed with every word the Chairman had said. At Hornsey, they had a very fine gas-works, maintained in an excellent condition. Certainly, there was no need whatever to worry about the Hornsey Company.

Mr. J. W. BUCKLEY, responding to the vote, on behalf of himself and the other officers, said they were proud to be connected with a Company occupying the distinguished position of selling the cheapest gas in London. They had been very ably supported by the Directors. Without such a technical Board as they possessed, in all probability the undertaking would not have been in its present unique position. It was no small achievement to be in a position, not only to sell such cheap gas, but also to pay the dividends which the shareholders received in pre-war days.

Mr. G. F. CHURCH proposed a hearty vote of thanks to the Chairman and Directors for their able management of the affairs of the Company.

This Mr. E. L. BURTON seconded, and it was heartily accorded.

SOUTH SHIELDS GAS COMPANY.

Reduction in Price Announced.

Presiding last week at the annual meeting of the South Shields Gas Company, Sir JAMES READHEAD, Bart., announced that the Directors had decided to make a reduction of 9½d. per 1000 c.ft. in the price of gas (2d. per therm), as from the March reading of the meters.

In moving the adoption of the report and accounts, the Chairman said the Directors fully realized that the present high price charged for gas did not tend to encourage a greater use of the commodity; and they had constantly before them the necessity of reducing the price when at all possible. With the reduction announced, the price to be charged next quarter would be equivalent to 4s. 4½d. per 1000 c.ft., which made the total reduction as compared with the October-December quarter 1s. 1¾d. per 1000 c.ft. Based on last year's consumption, the total reduction represented a saving to the consumers of approximately £40,000 per annum. The quantity of gas sold in the twelve months ended Dec. 31 last was 703¼ million c.ft., being an increase of 2·18 p.ct. as compared with the previous year, which, considering the depression in trade, was very satisfactory. On the other hand, the income from residuals in 1920 was £123,900, while last year there was a reduction in receipts from this source of £65,000. During the year application had been made to the Board of Trade for an Order to sell gas on the therm basis, and to fix a new standard price to meet the increased cost of manufacturing and supplying gas under present-day conditions. After an exhaustive inquiry, during which the Company were opposed by the local authorities, they came out in a very satisfactory manner. The provisions of the Order were put into operation on Dec. 1; and the Board thought that the new system would be to the advantage of the consumer, as well as of the Company. In looking forward to the future, the Directors had the fullest confidence in the success of the Company. In thanking the officials and workmen of the Company for their loyal co-operation, the Chairman said they had not had a single stoppage of work during the past year.

The report was adopted, and dividends were declared for the year of 8½ p.ct. on the consolidated and new stocks and 5¾ p.ct, on the ordinary stock, both less income-tax.

Urmston against the Stretford Gas Board.—A poll taken at Urmston last Saturday to decide whether the ratepayers were in favour of the Stretford Gas-Works being acquired by a Joint Board from the Manchester Corporation, went against the proposal. The figures were: For the Board, 135; against, 1444—majority against, 1309. This adverse vote may not seriously affect the position of the local authorities, as there is still a majority of 1340 in favour of the Joint Board. Stretford and Ashton have voted in favour, and Sale and Urmston against.

BARNET DISTRICT GAS AND WATER COMPANY.

The Half-Yearly Meeting of the Company was held last Monday the London Offices, No. 139, Cannon Street—Mr. ARTHUR F. PHILLIP in the chair.

The SECRETARY (Mr. E. D. Davey, A.C.A.) read the notice convening the meeting; and the Directors' report and the accounts were taken as read.

The CHAIRMAN, in moving the adoption of the report and accounts, said that when the proprietors met last August, gas companies had passed through the most trying times. There had been three months' strike of the coal miners, when imported coal had to be purchased at enormous prices and much of it of inferior quality; and labour was also during the first half of the year at maximum rates. Taking it as a whole, the year 1921 would be remembered by gas companies as having caused more anxiety to those having the management of undertakings than any year that had preceded it. During the past six months some coal had had to be carbonized which had been purchased at high prices; but there had been no difficulty in obtaining all the coal required, and with the close of the year reductions in prices had been announced. There had also been reductions in labour charges. The sale of gas had been well maintained and showed an increase of nearly 2 p.ct. There was no expenditure on capital account during the half year, but a credit for depreciation of £253. The gas rental showed a slight increase, being £31,724 against £30,975 in the corresponding previous half year; the price being the same. Bye-products realized £10,444, against £10,766. On the expenditure side, coal cost £20,484 against £18,776; while oil and coke for carburetted water gas cost £1865 against £1180. Carbonizing wages showed a reduction—£3411 to £2701. All other charges were much the same; but while the total income was £46,473, against £45,726, the expenses were £39,789 instead of £37,192. This resulted in a reduced profit of £6683 (against £8534), notwithstanding every endeavour having been made to work as economically and as efficiently as possible. On the water undertaking there was an expenditure on capital account of £1360 for additional mains and services. There was also an expenditure of £4365 on filters and other work for the North Mymms Pumping Station, which was charged to the contingency fund. This was a necessary work to meet the increasing consumption of water in the Company's extensive water district. The water revenue was £27,900, against £26,983; whereas the expenditure was £19,692, against £17,734. The increase was chiefly due to the pumping charges. The profit was £8326, compared with £9357 the previous year. The balance of profit and loss from last half year, after paying the dividend, was £23,412; and adding to this the balance from the gas and water undertakings, this half year gave £38,666, and deducting from it the charges for income-tax and debenture interest left an available balance of £31,649, from which the dividends recommended would take £10,383—leaving £21,265 to carry forward, or £2147 less than the previous half year. To pay the dividend for the first half of the year it was also necessary to draw upon the profit and loss; but it was realized that that half year was an abnormal one because of the coal strike. The Company could not continue to reduce the profit and loss to meet the dividends. The dividends paid had always been reasonable, and revenue should produce the necessary money to meet them. The Company held back from making an application under the Gas Regulation Act as long as possible. This had now been made, and the result should be satisfactory. An application had also been made, under the Water Undertakings (Modification of Charges) Act, 1921, for a reconsideration of the water charges. This was most important, for it was not reasonable to expect a water company to meet the great increase in the cost of working for coal, wages, and all material required, without an increase in the charges for water. The applications for an increase in the water charges were general throughout the kingdom. Even the Metropolitan Water Board had greatly increased their charges to the vast district of London which they supply. Without such consideration the Company would not be able to carry out its obligations or to raise additional capital. A water company has no means of meeting the additional expenses except by an increase in the water charges.

The DEPUTY-CHAIRMAN (Dr. J. W. L. Glaisher, F.R.S.) seconded the motion, which was carried unanimously.

The CHAIRMAN next proposed, and it was seconded by Mr. ALFRED WOOD, that dividends (less income-tax) for the half year should be declared at the rate of 9 p.ct. on the "A" and "C" stocks, 8 p.ct. on the "B" stock, and £6 6s. p.ct. on the "D" capital gas and water stocks. This was carried unanimously.

Dr. J. W. L. Glaisher and Mr. William Richards were the retiring Directors. Their re-election, proposed by the CHAIRMAN, with felicitous remarks as to their services to the Company, and seconded by Mr. COLIN DOGWRA, was unanimously voted. After their acknowledgment of indebtedness,

The CHAIRMAN referred to the absence on important business of Mr. C. D. Holroyd, the retiring Auditor. His re-appointment was proposed by Mr. F. R. SMITH, seconded by Mr. CHAS. CHAMBERS, and carried.

A hearty vote of thanks to the Chairman and Directors, whose work was so much appreciated, was accorded them. In acknowledging this on behalf of his colleagues and himself, the CHAIRMAN desired to express their indebtedness to their officers, especially Messrs. Davey and Bancroft (the Engineer and Manager), and the staff and workmen. He moved a vote of thanks, which was seconded by Mr. C. P. CROOKENDEN and carried with acclamation.

Mr. BANCROFT'S reply, on behalf of all those included in the vote, brought the proceedings to a close.

Death while Repairing a Gas-Pipe.—Overcome by gas fumes, an Alyth master plumber, named Peter M'Donald, was found unconscious in his shop, and died without regaining consciousness. Apparently he had been repairing a gas-pipe in the back premises of his shop, and became overpowered by the fumes. Artificial respiration was applied; but it was unavailing.

UXBRIDGE AND GREAT MARLOW AMALGAMATION.

Terms of the Agreement.

Ordinary and Special Meetings of the Uxbridge, Wycombe, and District Gas Company were held last Thursday afternoon, at Palace Chambers, Westminster, S.W.—Mr. H. E. JONES (the Chairman) presiding.

The SECRETARY (Mr. George J. Bristow) having read the notice convening the ordinary meeting,

The CHAIRMAN, in moving the adoption of the report and accounts, said he had to refer with great regret to the recent death of Mr. Sidney Fassnidge, who had served on the Board for something like twenty years, and throughout the whole of this time had given very careful and constant attention to the business. They had been through the most terrible miners' strike; and it was therefore of no use attempting to compare the transactions of the past year with those of any previous period. As a matter of fact, he might tell the shareholders that the Company were supplying gas during the three months of the miners' strike at a loss of from 1s. to 1s. 3d. on every 1000 c.ft. sold. However, he was pleased to say that they went on "pegging away," and kept up the supply to the consumers, who would otherwise have had nothing to cook with or to use for warming themselves. Under the circumstances, the price of gas had to be raised; and during the last part of the year it was very heavy, and the gas was not so good as it should have been, owing to the poor quality of the coal they had had to buy. They expected to be able next midsummer to give the consumers a large reduction in price; but there was no chance of doing so before. The Company owed something like £40,000 to their bankers, which was a serious amount for an undertaking of that size. They already possessed power to raise certain capital; and the Board proposed to issue short mortgage loans from time to time in reasonable amounts, so that the existing shareholders and the employees might be in a position to take them up. They also intended immediately again to put into operation a system which had proved of great value to them in former days. He referred to the supply of gas and fittings on the prepayment plan, the extension of which had been discontinued nearly two years ago. It was then found they were paying about four times as much for meters, stoves, and fittings as they had been in former times; and they were bound by law to charge for gas supplied by this system only 10d. or 11d. per 1000 c.ft. extra. This was amended when they got their new Order fixing the price by the therm. This gave them power to charge half as much again as before; and, besides this, the price of the appliances to which he had referred had come down to only about double what it used to be. The Directors, therefore, thought it wise again to get on with work in this direction. In a few months he thought they might get back to the normal yield of 10 p.ct. profit on this kind of business, which seemed to him to be the minimum which they ought to expect on such outlay. Referring to the Gas Regulation Act, he remarked that with the new system of heat value they could work with a smaller margin of safety than was possible when they were working on a candle-power basis. When the Company went for their Order, they were very fairly treated by the Board of Trade. When the Great Marlow agreement which they were about to consider took effect, they would have a territory of something like 192 square miles, which would make them an extensive undertaking; and as it was a district that must improve rapidly, they would in (say) twenty years' time be a very important Company indeed. In conclusion, he pointed out that the total profits were sufficient to enable the Board to recommend a dividend which, with the interim payment, would make £5 13s. 9d. for the year.

The report and accounts were adopted; and the retiring Director (Mr. H. S. Button) was re-elected.

The meeting having then been made special, the following resolutions were submitted from the chair.

1.—That the provisional agreement dated Nov. 4, 1921, and made between the Company of the one part and the Great Marlow Gas Company, Ltd., of the other part, being an agreement for the transfer of the undertaking of the Great Marlow Gas Company to the Company be, and the same is hereby, approved.

2.—That the draft of the Special Order for which application has been made to the Board of Trade under section 10 of the Gas Regulation Act, 1920, to provide for the transfer of the undertaking of the Great Marlow Gas Company to the Company, to extend the limits of supply of the Company, and to authorize them to store gas on certain lands acquired by them in the parishes of Wooburn and Little Missenden in the county of Bucks, and for other purposes, be, and the same is hereby, approved, subject to such alterations as the Board of Trade may make therein and of which the Directors may approve.

3.—That under the powers conferred by the Uxbridge, Wycombe, and District Gas Act, 1920, the Directors be, and are hereby, authorized from time to time to exercise the borrowing powers of the Company by the creation and issue of redeemable or irredeemable debenture stock, and (or) by borrowing on mortgage to an extent not exceeding one-half part of the amount of the capital for the time being of the Company, which at the time of borrowing has been raised—such debenture stock or mortgages to be issued to such persons on such terms and conditions, bearing such rate of interest, and at such prices, and to be repayable at such date or dates, as the Directors may think fit.

Mr. A. J. LEES (the Solicitor) then explained briefly the nature of the agreement that had been come to between the two Companies. He said that the capital of the Great Marlow Company consisted of £9000 entitled to a maximum dividend of 10 p.ct., and £13,000 odd which was entitled to a maximum dividend of 7 p.ct. The agreement provided that the Uxbridge Company should be entitled to charge within the Marlow limits what was the equivalent of the difference—which was 7d. per 1000 c.ft.—between the old standard price of the Uxbridge Company and the maximum price of the Marlow Company, and that without affecting the Uxbridge dividend. It was proposed that the transfer of the undertaking of the Great Marlow Company to the Uxbridge Company take effect as from Jan. 1 or July 1 immediately preceding the date of the Special Order. For every £10 share of the Marlow Company entitled to 10 p.ct., there would be issued £16 of the Uxbridge Company; and for every £10 share entitled to 7 p.ct. dividend, £11 4s. of ordinary stock in the Uxbridge Company. The basis of the transfer was that, before the war, the Great Marlow Company were paying 10 p.ct. on the 10 p.ct. maximum shares; and the stock they would get in the Uxbridge Company would pay them the equivalent of this. That dividend was not to be increased unless and until the highest dividend paid to the Uxbridge shareholders before the war was increased. The proposal was that the Uxbridge Company should take over the undertaking "lock, stock, and barrel"—reserve fund, and everything else, including an equitable mortgage of £8000 odd. The Directors were to receive as compensation for loss of office £625; and £1500 was to be paid to the Secretary of the Marlow Company.

The CHAIRMAN said he could not speak too highly of the scheme, which he urged the shareholders to accept. He moved the resolutions already referred to.

Mr. BUCKLAND seconded the motion, emphasizing the importance to the Company of carrying through the amalgamation, which must at the same time improve the Wycombe district.

The resolutions were unanimously carried; and the proceedings closed with a vote of thanks to the Chairman and Directors, on the proposition of Mr. W. RICHARDS.

BRITISH INDUSTRIES FAIR (BIRMINGHAM).

Under auspicious circumstances the Birmingham section of the British Industries Fair was opened on Monday last at the Exhibition Buildings, Castle Bromwich. The Fair, which has already claimed a large number of visitors, will remain open until March 10—the period is, in fact, the same as that of the London section. Visitors generally are greatly impressed by the very comprehensive character of the Fair—it is more representative of Midland industry than either of the two previous exhibitions—and by the maintenance of a high quality standard. There is scarcely any evidence of a desire, in order to do business, to produce goods of a cheap and shoddy character. Overseas visitors on Monday—and there was a fairly good number from the Continent—declared that British makers are to-day most willing to produce precisely according to their specifications.

The Lord Mayor of Birmingham (Alderman David Davies) presided at luncheon on the opening day, and expressed the hope that the Fair would give a much needed impulse to overseas trade. Mr. Herbert O. Worrall, the Chairman of the Council, said he was satisfied that British industry and commerce had touched the worst of the prevailing depression, and that the upward swing of the pendulum had commenced.

THE EXHIBITS.

The exhibits number 500, and the stands occupy an area of 60,000 ft. This is a slight decrease numerically compared with last year; but, on the other hand, several of the largest Midland firms who have not hitherto appeared in the schedule display an exceptionally wide range of manufactured goods. The Fair affords a wonderful object lesson as to the amazing diversity of Midland industries. The leading features are, as might be expected, the groups devoted to general engineering, and to brassfoundry and hardware. Machine tools and the like occupy a large amount of space, as do also gas-engines, and lighting and heating equipment (gas and electric). There is also a large section devoted to constructional engineering. The schedule, enlarged this year, includes mining, colliery and quarrying machinery and appliances, and also equipment for the needs of agriculture, dairying and poultry keeping, brewing, distilling, and cold-storage plant, and catering, &c. Of these, the mining and allied industries are well represented.

There are four large stands devoted to gas-engines, nine almost exclusively to gas-fittings, &c., four to gas-fitting tools, four to gas-furnaces, and there is a moderate show of furnaces, automatic controllers, radiators, and mantles. The Birmingham Gas Department show two "Tilley" gas-compressors, each of 1000 c.ft. per hour capacity. These are used for raising the pressure of the gas for supplying 43 overhead high-pressure lamps for the lighting of a building. The importance to industry of the Gas Departments' Industrial Research Laboratories is emphasized by a collection of apparatus for the general testing of metallurgical materials, &c.; and demonstrations are given under the direction of Dr. Walter.

Details of the exhibits will be given next week.

Winchester Water and Gas Company.—At the half-yearly meeting of the Company last Monday, it was reported that on Nov. 29 an Order under section 1 of the Gas Regulation Act was issued, which abolished the old statutory maximum price of 5s. per 1000 c.ft., and substituted a new maximum price of 18·4d. per therm. The Company declared, in pursuance of the Order, the calorific value of the gas to be supplied to be 450 B.Th.U. per cubic foot. The price of gas throughout the half year was 6s. 5d. per 1000 c.ft.; and the price now being charged is 1s. 5d. per therm, which, at 450 B.Th.U., is equivalent to 6s. 4½d. per 1000 c.ft. On Dec. 28, the Board of Trade revoked the Company's Temporary Increase of Charges Order, and thereby removed the restriction limiting the dividend to £3 2s. 6d. p.ct. per annum. The balance of net revenue available for dividend was £4194, and the Directors recommended the payment of a dividend on the preference stock at the rate of 4 p.ct. per annum (less income-tax), and on the consolidated ordinary stock at the rate of 4¾ p.ct. per annum (less income-tax), for the half year. This would absorb £3966, leaving a net balance of £228 to be carried forward. In consequence of the increase in costs of pumping and supplying water attributable to circumstances beyond the control of the Company, application is being made to the Minister of Health for an Order under the Water Undertakings (Modification of Charges) Act, 1921, to empower the Company to increase the water charges.

ASHBOURNE GAS-WORKS EXTENSION SCHEME.

The Ashbourne (Derbyshire) Urban District Council have considered a report from the Gas Manager with regard to important extensions that are being contemplated at the gas-works. In his report, the Gas Manager (Mr. H. J. Harrison) stated that it had become necessary to increase the storage capacity; and the Gas Committee, after consideration, came to the conclusion that some extension must be made. The existing storage capacity was 90,000 c.ft., and the producing capacity 216,000 c.ft. per day. There was also need for other improvements and additions of an extensive nature. The scheme of extensions would include a new holder, valves, and re-arrangement of the purifier connections, station governor-house, works mains, station governor, and coal storage accommodation. The proposed new spiral holder would have a capacity of 200,000 c.ft.; and the works would be equipped for a 70 million c.ft. output per annum. The present storage capacity was only 50 p.ct. of the maximum output this winter. The output this year would show at least 40 p.ct. increase on the annual output when the Council acquired the undertaking.

The Chairman (Mr. T. Kennedy) said they were sorry to find the time had come when something would have to be done with regard to the gas undertaking. The question of the provision of a new holder had been put off from year to year; and it was very unfortunate that they did not undertake the scheme before the war, as it would cost much more to-day. At present they were not definitely committed to any scheme; and they thought they would consult the Council before embarking upon what would be very costly extensions. The position to-day compared with the time when the works were taken over by the Council was literally reversed, as formerly the night consumption exceeded the day load, but now, owing to the large number of gas-cookers and heaters in use, the day consumption was the greater. He considered the prospects of the undertaking were considerably brighter now. The recommendation of the Gas Committee to proceed with the extension scheme was adopted.

UNSCIENTIFIC STREET LIGHTING.

The February issue of the "'Sentinel' Transport News" has the following to say upon the subject of "Unscientific Street Lighting."

Satisfaction with the present methods of street lighting cannot be expressed. That is the decision of a meeting of lighting experts at the recent Public Works, Roads, and Transport Congress at the Agricultural Hall. At present, a driver of a fast vehicle proceeds from a brilliantly, if spectacularly, lit road to a dimly lit street, and is virtually blinded for a period.

The lighting on the Regent's Park Road in North London, at the dip after the Addison Way hill, is an example of unscientific lighting. There are open spaces on both sides of the road; but notwithstanding this fact, two brilliant gasfilled bulbs are placed on each tramway standard, without any reflecting shade whatsoever. The result is that much of the lighting goes to illuminate the adjoining fields; and, while the road is lit brilliantly in small patches, large spaces are left in darkness. It may not be economic to illuminate all roads in the same manner; but it cannot be too strongly urged that lighting from a main street to an unimportant side street should be graduated in brilliance. The lighting, also, should be diffused on to the road, and not thrown on the faces of drivers.

The Secretary of the Illuminating Engineering Society states that between the London Hospital and Bayswater there are seven different methods of lighting in use. From all points of view, there is a call for a standard method of street lighting. In this connection, the best unit of lighting would appear to be the gasfilled bulb, with the whole of the neck sunk in a very large dish-shaped reflector—such as is very successfully used by the Finchley authorities. The 1-watt vacuum bulb is wasteful, when compared with its ½-watt brother; while arc lamps are both troublesome and wasteful, and apt to cast shadows.

Centenary at Carmarthen.—Among the oldest gas undertakings in the country is that at Carmarthen; and at the annual meeting of the Company, this fact was commented upon by Mr. A. Soppitt (the Chairman), who said that the Company were this year celebrating their centenary, having been established in 1822, and incorporated in 1870. The Chairman, in reviewing the year's working, said he really thought that at last they were beginning to turn the corner. Despite the greatest coal strike the country had ever suffered, they made a satisfactory profit; and the Directors felt justified in reducing the price by 7d. per 1000 c.ft. from the end of the year. Ignoring public lighting, which the Company had not had for years, the quantity of gas sold—25,017,000 c.ft.—was practically their high-water mark. Dividends were declared of 5⅝ and 5¾ p.ct. on the respective shares.

Hartlepool Gas and Water Company.—In submitting to the proprietors the accounts for the year ended Dec. 31, the Directors pointed out that the revenue was £176,381, and the expenditure £164,562, leaving a balance as profit for the year of £11,819. With the balance of undivided profit brought from the previous accounts, there was a total of £33,479, which it was proposed to appropriate as follows: Interest on loan capital, &c., £7762; interim dividend to June 30 at 2½ p.ct., £11,761; dividend to Dec. 31 at 1 p.ct., making 3½ p.ct. for the year, less income-tax, £4704—leaving a balance to be carried forward of £9251. The large decrease in the divisible revenue was chiefly attributable to the miners' strike, and to a reduced consumption of water for trade purposes, due to the trade depression, and the serious increase in local rates and taxes. An application has been made to the Minister of Health under the Water Undertakings (Modification of Charges) Act, 1921, for an order empowering the Company to increase the statutory charges for water supplied for domestic purposes. The contract for the renewal of the remaining retort-bench in No. 2 retort-house has been satisfactorily completed.

ILLUMINATING ENGINEERING SOCIETY.

Annual Dinner.

Some interesting addresses were delivered at the Annual Dinner of the Illuminating Engineering Society held on Feb. 10, presided over by Sir JOHN H. PARSONS, C.B.E., F.R.S. (the President).

Sir HERBERT JACKSON, who, on behalf of the Royal Society, proposed the toast of "The Illuminating Engineering Society," congratulated the President on the well-deserved knighthood conferred upon him. He took a leading part in the earliest discussions on "Glare and the Effect of Light on the Eye." The toast was also supported by Mr. J. B. Lawford (Chairman of the Council of British Ophthalmologists). In responding, the President reviewed the work of the Society since its commencement in 1919, and alluded particularly to the opportunities it presented for co-operation between those concerned with the various aspects of lighting.

Mr. F. W. GOODENOUGH, in proposing the toast of "Kindred Societies," expressed his appreciation of the common meeting ground afforded by the Society for engineers concerned with both gas and electric lighting. Mr. Thos. Hardie (President of the Institution of Gas Engineers) and Mr. A. A. Campbell Swinton (Vice-President of the Institution of Electrical Engineers, and Chairman of the Royal Society of Arts) both referred to the growing tendency to co-operation between those concerned respectively with the supply of gas and electricity—a tendency which would no doubt become more marked in the future.

Mr. LEON GASTER, proposing the toast of "The Guests," mentioned that the Society had always had a favourable experience of Government departments, who had invariably responded sympathetically to the offers of assistance by the Society. Mr. R. E. Graves (H.M. Chief Inspector of Factories) and the Rt. Hon. William Brace (Mines Department) paid a tribute to the work of the Society in the fields of industrial lighting and illumination in mines; and Mr. H. E. Blain (Hon. Secretary of the British Industrial "Safety First" Association) alluded to the valuable co-operation of the Society in studying the relation between the lighting of factories and workshops and "industrial safety."

Among others present at the dinner may be mentioned General Sir Frederick Symes (Controller of Civil Aviation), Mr. J. Herbert Fisher (President of the Ophthalmological Society), Sir William Lister, Mr. W. T. Holmes Spicer, F.R.C.S., Alderman Geo. Clark (Chairman of the Society of British Gas Industries), Mr. Joseph Orringe (President of the Electrical Contractors Association).

UNDERGROUND LONDON, OR MAINS AND MAINLAYING.

This was the title of an address given recently at Herne Hill by Mr. W. J. LIBERTY, who liberally accompanied his remarks by diagrams and sketches showing the method of placing and maintaining the mains, pipes, and services of gas, water, electricity, and other undertakings, below the level of the carriage and footways of cities and towns.

After pointing out the inconveniences that may arise through the filling of public roadways with pipes, Mr. Liberty went on to say that it is impossible to continue indefinitely the present system of mainlaying in central parts of large cities, owing to the roadway being in many cases completely filled with mains and pipes. In London, for instance, such large junctions of thoroughfares as Ludgate Circus, Regent Circus, and Queen Victoria Street, by Blackfriars Bridge, are so full of mains that it is almost impossible to place any more there. The remedy is to make under the roadways conduits, channels, underground streets, or subways to contain the whole of the pipes, valves, &c., of the various companies. In addition to the appliances for the companies, provision could be made for the supply of water to fire hydrants, to be fitted in the footpaths above, and supplies to street watering posts. The valves on all hydraulic, gas, and water mains up to 24 in. in diameter, and street-watering posts, could be fitted with spindles rising through the roof of the subway, and ending in a small cock-box in the roadway, to enable them to be turned on or off without having the subway opened. This would not obstruct the roadway, the boxes being about 3 in. or 4 in. square. Such a subway could be built down the centre of the roadway, having the sewer immediately underneath, with house-service galleries running at right angles, leading direct from the mains to premises along the street.

The subway would be semi-circular in shape, with a floor space about 12 ft. across, a height of about 7 ft. 6 in. from the floor to the under side of the archway. The depth from the centre of the roadway to the underside of the subway arch would be about 4 ft. 6 in. Service galleries, so placed that one only would be required to every two houses, would have a height of about 3 ft. 6 in. by about 3 ft. wide. The gas service-pipes, and pipes or cables for the supply to the street lamps, and of water to the hydrants and street-watering posts as well as the private supplies to the consumers, would be carried through these galleries. Piers of brickwork, about 1 ft. above the subway floor, would extend from the sides of the subway to the edge of the paved footpaths; and the gas, water, and other pipes would be laid upon these. In addition to the small piers for carrying mains, brackets would be fixed in the wall of the subway, about 9 ft. apart, to take 9 ft. lengths of mains, and lighting and telephone cables. In small towns, where the demand for pipe-space is not so great, it might not be necessary to take up the centre of the roadway and construct a large subway, as in London; for, in addition to the number of mains in London, their great size is a factor. Many of the trunk gas and water mains are 36 in. and 48 in. in diameter, and run side by side for miles. These are not met with in the smaller towns. Therefore he would recommend, as an alternative, a system of conduits about 3 ft. by 2 ft. 6 in. under the footpaths of the thoroughfares, with an additional conduit (say) 2 ft. 6 in. by 2 ft. in the roadway, sufficiently away from the kerb not to interfere with the street gullies and catch-pits. These conduits would contain sufficient small mains and cables for

supplying one side of the street; and a similar conduit would be constructed under the opposite footway. They would have a series of "inspection boxes" at the street corners, and at intervals of about 50 yds. for drawing in cables, &c. Each house would have a connection with the conduit. Such conduits would not only be suitable for small towns, but for the smaller streets of the great cities, where there is no room for subways down the centre.

A start was made with subways, such as have been outlined, in the City of London in 1864 by Col. Haywood, Engineer and Surveyor to the City Commissioners of Sewers, and by the Metropolitan Board of Works in Southwark about the same time.

WANDSWORTH, WIMBLEDON, AND EPSOM DISTRICT GAS COMPANY.

The report which will be submitted at the meeting next Tuesday states that the accounts for the year ended Dec. 31 show a decrease of 4·75 p.ct. in the sale of gas. The revenue account for the year shows a profit of £82,906; and, after providing for the interest on mortgages and debenture stock, and on deposits and loans for the twelve months, and the dividends for the six months ended June 30, 1921, there remains to the credit of the profit and loss (net revenue) account an amount of £32,618. Through the fall in residuals and the large rise in the cost of coal, the price of gas had to be raised 6d. per 1000 c.ft. at Lady Day; and in consequence of the coal miners' strike, the purchase of large quantities of inferior foreign coal, obtained with great difficulty at exorbitant prices, compelled the Company to increase the price of gas 2d. per therm at Midsummer. The price has since been reduced by 1d. per therm, with a further special reduction of ⅜d. per therm in the Wimbledon and Epsom areas. The Company have obtained an Order whereby the standard prices were fixed at 16⅜d. per therm in the Wandsworth and Epsom areas and 14⅜d. per therm in the Wimbledon area. The calorific value has been declared at 470 B.Th.U., which is in practical agreement with the standard fixed by the Company's Act of 1912. The Bill promoted in Parliament in the last session duly received the Royal Assent. This has enlarged the capital powers and increased the area of the site of the Epsom Gas-Works, besides making other useful provisions. Dividends for the six months ended Dec. 31 are recommended at the statutory rates: On the Wandsworth "A" stock, £6 12s. 6d.; on the Wandsworth "B" stock, £5 2s. 6d.; on the Wandsworth "C" stock, £4 12s. 9d.; on the Wimbledon stock, £4 10s.; on the Epsom stock, £5; and on the new ordinary stock, £4 12s. 9d. p.ct. per annum.

A SATISFACTORY REPORT AT YORK.

The accounts of the York Gas Company for the year 1921 showed that, after the payment of dividends of 4 p.ct. per annum on the "A" preference stock and £4 4s. per annum on the consolidated ordinary stock (both less tax), there was a balance of net revenue to be carried forward of £6028. In November last the Company obtained an Order from the Board of Trade by which 13d. per therm is substituted for 2s. 3d. per 1000 c.ft. as the standard price for gas; the standard dividend remaining at 4 p.ct. The Directors have given notice that the calorific value of the gas which it is proposed to supply will be 480 B.Th.U.; and the initial price for the year 1922 is 11½d. per therm. The quantity of gas sold during the past year was 657,439 000 c.ft., being an increase of 8,787,800 c.ft. At the meeting, the Chairman (Mr. Alfred Proctor) said that fortunately, after the complete results of the year's operations had been ascertained, it was found not to be necessary to enforce an increase in price of which notice had been given in December. He believed that there was very general satisfaction throughout the city with the really great achievement of the Company during the coal strike; and it was a great satisfaction to the Board that those services had been so generally appreciated by the public. The balance of profit was not sufficient to provide the total dividends for the year; but there was a sum in the net revenue account representing undivided profits accumulated in more prosperous years for the express purpose of equalizing dividends. As a result of the prudent and far-seeing management of the finances of the Company in past years, the capital charges were extremely low; and therefore the proportion of revenue required to provide the remuneration of capital was very small. This was a source of strength to the Company, and at the same time a great benefit to the consumers. In conclusion, he testified to the excellence and efficiency of the services loyally rendered by Mr. H. E. Bloor (the Secretary and Manager) and the office and works staffs during a year of unusual difficulty and strain.

Further Reduction in Price at Deal.—An intimation has been made to consumers by the Directors of the Deal and Walmer Gas and Electricity Company that the notice of reduction in the price of gas sent out last December is amended, and that the reduction in price for the current quarter will be from 15d. to 13d. per therm—from 5s. 7½d. to 4s. 10½d. per 1000 c.ft. Thus the reduction will be 2d. per therm (9d. per 1000 c.ft.), and not 1d. per therm as originally announced.

Matlock and District Gas Company.—The nineteenth annual report of the Directors states that the revenue account shows a profit of £102, to which has to be added the unappropriated balance of £5707. The surplus for disposal is £4757; and the Directors recommend a dividend for the half year to December at the rate of 2s. 6d. per share (making 2½ p.ct. for the year, less tax). This is the maximum allowed on the present price of gas. The Directors announce with much regret the death of Mr. H. C. Heathcote, who had been connected with the Company as a Director for a number of years, and whose services were highly appreciated. Regret is also expressed at the death of Mr. Robert Hall, who had been Secretary of the Company from its formation in 1887, and who was for many years a Director. The devoted service that Mr. Hall rendered in both capacities was of the utmost value to the Company; and he will be greatly missed by his colleagues on the Board, and also by the shareholders.

CHESTER UNITED GAS COMPANY.

The report adopted at the meeting of the Company on the 20th ult. stated that the accounts for the half year ended Dec. 31 showed that the sales of gas had afforded an additional revenue of £5794, owing to the sale of an increased quantity of 10,365,000 c.ft.—equal to 6½ p.ct. Residuals showed a decreased revenue of £5113; and the total gross receipts were £56,167. Coals cost £4930 more than in the corresponding period of the previous year, of which £1908 was due to increased quantity used owing to the larger sales of gas, and the balance was the remainder of the extra cost involved by the coal strike. Reductions in costs of repairs on works and distribution charges more than met this additional cost of coal; and the total expenditure was £49,937, leaving a balance of profit of £6230. After providing for interest on debenture stock and dividend on preference stock, and bringing into account the net balance from the previous half year, there remained a balance of £4691, out of which the Directors recommended the payment of a dividend of 2½ p.ct. on the ordinary stock, making, with the interim dividend, the full maximum dividend of 5 p.ct. for the year. The Company obtained their Order from the Board of Trade on Dec. 15, under which they will, in future, have to charge for gas by the therm; and the new maximum price is fixed at 1s. 4d. per therm within, and 1s. 5·2d. per therm outside the city and county borough of Chester. The Directors have declared that the quality of gas they will supply shall be 460 B.Th.U. The Directors are now promoting a Private Bill in Parliament, mainly with a view to amend their powers of issuing new capital in consonance with current financial conditions. At the same time, they are seeking to obtain statutory authority to re-establish a co-partnership scheme in principle similar to that which was in force before the war, and to incorporate various modern statutory provisions introduced since obtaining the last Act in 1901. The Chairman (Sir John Frost) said that attention to the works had been given by the Engineer (Mr. J. H. Noble) during the past year, with a view to improving their efficiency; and this the Directors felt satisfied would be to the advantage of the employees, as well as of the manufacture of gas. The Company had given notice that the price of gas would be 1s. per therm (equivalent to 4s. 7·2d. per 1000 c.ft.), which was a very favourable one for the consumers. A new gasholder had long been needed, and its erection could not longer be deferred. No water gas had been supplied by the Company.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Feb.* 27.

The position of pitch appears to be very strong, as there is an unsatisfied demand from the Continent, with practically no stocks in this country. Makers put the price at about 75s. net per ton f.o.b. alongside producing works. Creosote is taking a more upward turn, as there is but a small quantity at present or in the future available for export; while it is said that some users are getting anxious as to supplies. In this situation it is not easy to indicate a price; but probably 6½d. to 6⅝d., in bulk, is obtainable. Other tar products are unchanged.

With respect to sulphate of ammonia, it appears clearly that there is a world-wide shortage of this material, notwithstanding all that uninformed prophets have said for some time as to the dismal outlook for the product. It is useless to indicate a price, as supplies are nearly unobtainable.

Tar Products in the Provinces.

Feb. 27.

Markets for tar products have been gradually steady throughout the week, with the possible exception of creosote, which is still a very dull market. Pitch is very steady indeed. Most makers are well sold, and are not inclined to deal for this season except at an advance on the figures quoted to-day. For next season there does not appear to be very much demand at present—certainly not at the prices demanded for prompt. Solvent naphtha and heavy naphtha are still quiet, with little demand. Cresylic acid is very quiet indeed, and in some cases prices are talked about which would appear to be below the cost of production. Naphthalene is still neglected.

The average values for gas-works products during last week were: Gas-works coal tar, 32s. 6d. to 37s. 6d. Pitch, East Coast, 70s. to 72s. 6d. f.o.b., and 68s. to 70s. f.a.s. West Coast—Manchester, 65s. to 67s. 6d.; Liverpool, 65s. to 67s. 6d.; Clyde, 67s. 6d. to 70s. Benzole 90 p.ct. North, 2s. 1d. to 2s. 2d.; crude 65 p.ct. at 120° C., 1s. 5d. to 1s. 7d. naked at makers' works; 50-90 p.ct., naked, North, 2s. 1d. to 2s. 2d. Toluole, naked, North, 2s. 2d. to 2s. 5d. nominal. Coal tar crude naphtha in bulk, North, 9d. to 10d. Solvent naphtha, naked, North, 2s. 2d. to 2s. 4d. Heavy naphtha, North, 2s. 1d. to 2s. 3d. Creosote, in bulk, North, liquid, 4⅜d. to 4⅝d.; salty, 4⅜d. to 4⅝d.; Scotland, 4¼d. to 4½d. Heavy oils, in bulk, North, 6d. to 6½d. Carbolic acid, 60 p.ct., 1s. 8d. to 1s. 10d. Naphthalene, £12 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 5d. to 6d. per minimum 40 p.ct.; "B" unsaleable.

FROM A MARKET CORRESPONDENT.

Bye-Products Trade.

Considerable irregularity is to be noted in the market for tar products. In the North of England the feeling is depressed; but this is probably because the outlook for pitch is more favourable. In other directions prices are rather weak. At the same time, if a higher range of values can be established for pitch, it will make a material difference to the tar distiller, whose intake of tar at the moment is rather small. There is, however, a prospect of increase in deliveries of tar, partly through the opening-up of more blast-furnaces and the consequent demand for coke, and partly because coke is now going to the Continent in fair quantities. Pitch shows very little change in price. The

demand for solvent naphtha is quiet, and 2s. 6d. per gallon is reported as current value. Naphthalenes are without change, with refined at £15 to £18, and crude £5 10s. to £8. If there is a change in creosote it has been in the downward direction, with prices at 5d. to 5½d. per gallon. Carbolic acid is rarely mentioned, and business appears to be quite dead. The price of crude 60's remains at 1s. 6d. per gallon, and crystals 5d. to 5½d. per lb. Cresylic acid is plentiful, and is quoted at 2s. per gallon on rail for pale quality, and 1s. 9d. per gallon for dark quality; 90's benzole is also plentiful, and can be had at 2s. 4d. per gallon at makers' works. Pure benzole is not much wanted, but can be obtained at 2s. 8d. and 2s. 9d. per gallon on rail. Trade in intermediates has been quiet, though there have been several inquiries on both home and export account, and stocks of many products are getting short. There is no material change in quotations.

Sulphate of Ammonia.

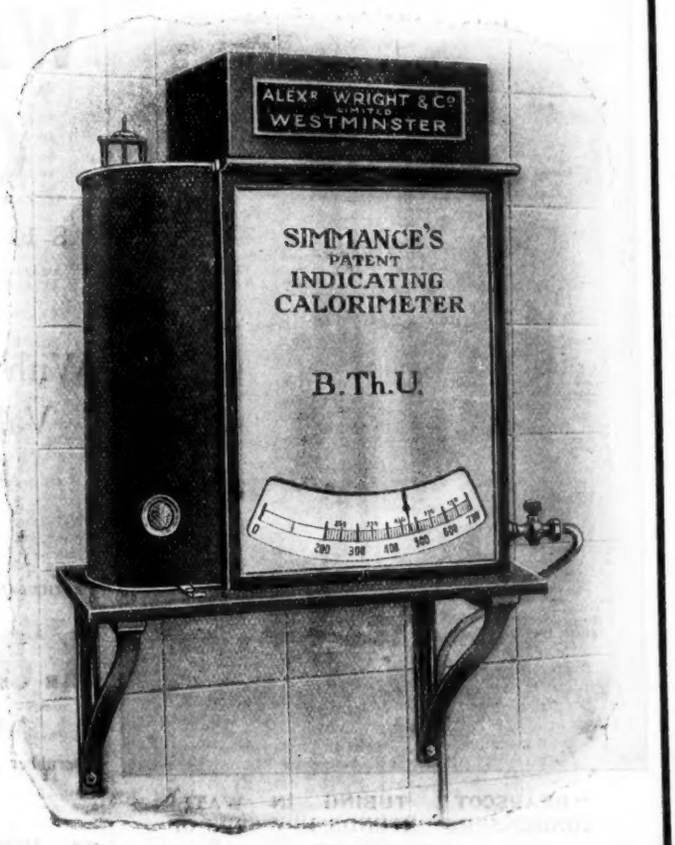
The demand continues on a fairly satisfactory scale, and much more business is being done with the near approach of the season of application. The outlook for greater production is also brighter, owing to further activity of the coke plants in South Wales and the North of England; but though the supply is increasing, it is only sufficient to keep pace with the current demand. Export business continues very brisk. Many buyers who have recently been placing orders in America are now coming to this market, as the American market is full of orders for some time to come, and is not even in a position to supply its own home consumers. There is no change in the prices recently fixed by the Association, which are, for March, April, and May deliveries, £16 per ton for 25¼ p.ct. ordinary, and £17 per ton for 25¾ p.ct. neutral quality. Export prices are 10s. to 15s. per ton in excess of home prices.

Pudsey Gas Company.—The Directors reported at the annual meeting that the sales of gas in 1921 showed a decrease of 3·88 p.ct. as compared with the quantity sold in 1920. The national strike of miners caused grave anxiety to the Directors; but, notwithstanding the difficulties encountered and the enormous expenditure, the Company carried out their obligations and maintained the supply of gas. The returns for residual products suffered materially during the year, owing to trade depression and other causes. The Company's application to the Board of Trade for an Order under section 1 of the Gas Regulation Act was granted in December. The standard price fixed by the Order is 1s. 1·4d. per therm, in place of the old standard price of 3s. 1d. per 1000 c.ft. The calorific value declared by the Company—500 B.Th.U.—came into operation on Jan. 1; and from this date the price charged for gas will be 11·8d. per therm. An interim dividend was paid in August at the rate of 5¼ p.ct. per annum on the new consolidated 7 p.ct. stock; and the Directors recommended a dividend for the past half year at the rate of 5¼ p.ct. per annum.

Bath Gas Light and Coke Company.—The opening paragraph of the report of the Directors for the year ended Dec. 31 contained an expression of regret at the loss of the services through death of their friend, colleague, and Vice-Chairman, Mr. S. Fox-Andrews, who served the Company as a Director for a period of 22 years. The vacancy thus caused has been filled by the election of Mr. H. Stanley Taylor. The Directors went on to say that, notwithstanding the disastrous miners' strike, they were pleased to be in a position to present a fairly satisfactory statement of accounts. The Company were able during the whole of the strike to maintain a supply of gas to the consumers; and, though the cost of so doing was heavy, it was decided not to increase the price of gas. Since the termination of the strike there had been a welcome reduction in the price of coal, which had partly met the heavy additional expenditure incurred during the strike; but the advantage derived from this source is now counteracted by the present heavy reduction in the prices of residuals. During the year application was made to the Board of Trade for an Order to enable the Company to supply and charge for gas on the therm basis. The Directors, following their action of previous years, have set aside a further sum of £5000 to meet the cost of work on renewal of plant delayed by the war. An interim maximum dividend of 5 p.ct. per annum (less income-tax) was paid for the half year to June; and the Directors recommended the declaration of a dividend at the same rate (less income-tax) for the half year ended December.

East Grinstead Gas Supply.—Mr. W. H. Hills, the Chairman of Directors, presided at the annual general meeting of the East Grinstead Gas and Water Company on Thursday last. The Directors' report showed that the receipts from the gas-rentals in 1921 amounted to £17,317; from residual products, £4822; and from water, £5236. The Directors recommended dividends at the rate of £9 p.ct. per annum on the original "A" stock and "A" shares, and £6 6s. p.ct. per annum on the "B" and "C" shares. The present outlook was more favourable than it had been for some years past. The Chairman said it was gratifying to note that the income from the sale of gas and residual products, rental of meters, &c., showed an increase of £2530 over that of 1920; but this was greatly discounted by the fact that their expenditure had increased by no less than £3493. Coal and oil cost £2372 more than in the previous twelve months, salaries and wages rose by £525, and the rates and taxes chargeable to the gas account by no less than £200. The results were that the profits on the gas portion of their undertaking fell by just over £900 from what they were in the previous year. Had they followed the example of many companies throughout England and raised the price of gas, they might have more than maintained their profits; but the Board had been loath to do this, and had kept the charge for gas at the low figure of 5s. 6d. per 1000 c.ft., which was the same as had been charged by the largest London company, and 1s. 9d. less than the average charge made last year in some similarly situated districts of Kent, Surrey, and Sussex. The accounts were adopted, and the dividends recommended were declared.

CALORIFIC POWER AT A GLANCE.



Alexander Wright
& CO., LTD.,
WESTMINSTER, S.W. 1
SOLE LICENSEES.

Cleveland Gas Company.—A meeting of shareholders of the Cleveland Gas Company was held at Saltburn on Tuesday last week, when the Directors' report stated that the half year's working showed a loss of £586, which, deducted from the balance from the previous half year, left a sum of £125, which it was recommended should be carried forward. The Directors said that the great stagnation in the iron and steel trade in Cleveland during the half year, as well as the excessive local rates levied, were answerable for the unsatisfactory results. They could not hold out any prospect of a substantial improvement during the current half year, unless the slight indication of a trade recovery, now visible, rapidly and substantially materialized. The report was adopted.

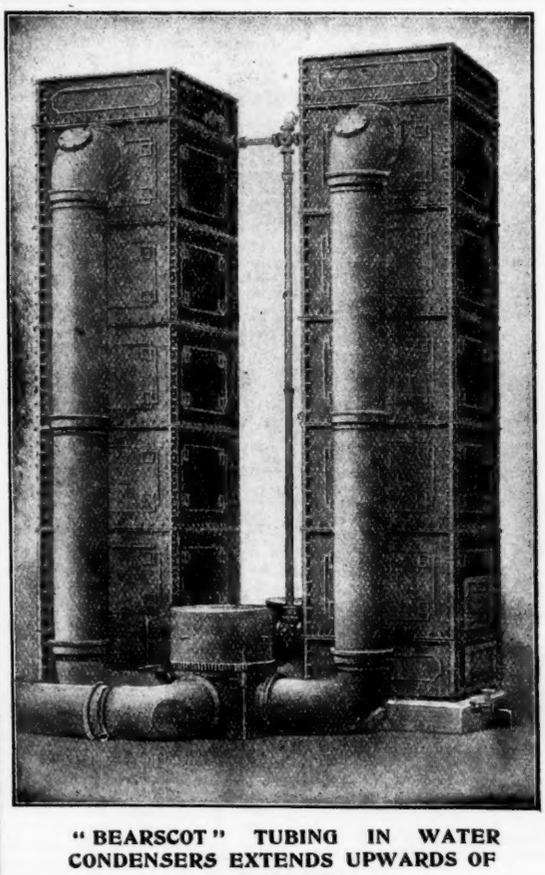
Capital Powers at Cambridge.—It was stated in the report for the six months ended Dec. 31 of the Cambridge University and Town Gas Light Company that during the past year the Company had obtained from the Board of Trade an Order authorizing gas to be charged for at per therm, and fixing a new maximum price of 14·8d. per therm. A Special Order has also been obtained under section 10 of the Gas Regulation Act authorizing an increase of capital by the borrowing on loan in respect of the existing share capital of the Company of a further sum of £47,000, the issue of additional share capital to an amount not exceeding £112,000, and the borrowing of a sum of £56,000 in respect of such additional share capital. The Directors recommended payment of a dividend at the usual rates.

A Small Reduction in Sales at Colchester.—A small reduction of 2 p.ct, in the gas sold during the past year as compared with 1920 (due chiefly to the reduced garrison at the barracks) was reported at the meeting of the Colchester Gas Company. The supply of gas was fully maintained during the coal stoppage, a period of fourteen weeks, for eleven weeks of which the stocks of coal held by the Company, eked-out in every possible way, sufficed. After this, foreign coal of inferior quality at very high prices had to be used. Later in the year the price of coal fell considerably, and also the cost of labour. On the other hand, there was a reduction in the market value of residual products, but not sufficient to counteract the savings referred to. The result of the past half year's working had been to provide a balance on revenue account of £4859, after charging for depreciation, repairs, and renewals fully against the account. This sum was more than sufficient to pay the mortgage interest and the full statutory dividends on the preference stock and ordinary shares. The capital of the Company has been increased very considerably during the past few years; but the new plant which has been installed has fulfilled all the expectations of the Directors by the savings effected in the cost of working, and this was to a large extent responsible for the favourable balance-sheet. The Company were one of the first to apply for, and obtain, an Order under the Gas Regulation Act, 1920, which changed the basis of the sale of gas from volume to heat units, and at the same time enabled the Company to resume the payment of the usual dividends for the June half year. The Directors announced that they had decided to reduce the price of gas as from Jan. 1 by 1d. per therm.

Fractured Gas-Main Accident in Westminster.—Charles Leon Lawrence, aged 65, was found dead in bed at his cellar dwelling, in Page Street, Westminster, with the place full of gas, though the taps on the bracket and the cooking-stove were turned off, and the fittings were not defective. As a result of inquiries by the Gas Light and Coke Company, it was found that the gas had percolated through the road soil from a 15-in. gas-main which was badly fractured. The main had been in position for fifty years; and was otherwise in good condition. There was only a small percentage of carbon monoxide in the gas which entered the cellar. Medical evidence showed that death was due to natural disease, accelerated by the inhalation of coal gas. The Coroner said he was satisfied that no blame attached to the Gas Company, and recorded a verdict of "Accidental death."

A Flueless Geyser Fatality.—At Battersea, an inquest was opened on Robert Charles Weech, who was found dead in a bath at 14, Sisters Avenue. Mrs. Weech said her son, who was a jockey, came home, asked for a bath, and directed her to keep the geyser on. The geyser was an old one, and had no flue. She usually opened the window when she used it. As her son was in the bathroom a long time the door was broken open; and he was found lying in the bath dead. The geyser was still burning. Mr. Charles Morgan, an Inspector of the South Metropolitan Gas Company, said the Company did not now fit geysers like this one. They were dangerous, because they were not flued-off. Another Inspector said that in November, 1919, he inspected this particular geyser, and subsequently reported it dangerous. Medical evidence showed that death was due to carbon monoxide poisoning.

Tunbridge Wells Gas Company and the Southborough Undertaking.—An Order was made by the Board of Trade last August authorizing the transfer to the Tunbridge Wells Gas Company of the gas undertaking of the Southborough Urban District Council. In the report which they submitted at the shareholders' meeting last Friday, the Directors stated that the purchase had been completed; and the Company were now in possession of the undertaking. It is anticipated that this extension of the Company's area will produce satisfactory results. As to the business of the past year, receipts for gas showed a substantial increase. Out of an available balance of £17,041, the Directors recommended final dividends which made for the whole year the standard rates of 10 p.ct. on the consolidated ordinary stock, 7½ p.ct. on the "B" stock, and 7 p.ct. on the "C" and "D" stocks—leaving £12,934 to be carried forward. The Company have secured an Order under the Gas Regulation Act, and have given notice to supply gas of a calorific value of 450 B.Th.U. The standard price in respect of gas supplied within the borough has been fixed by the Order at 16·2d. per therm, in substitution of the old standard of 3s. 9d. per 1000 c.ft., and 18d. per therm beyond the borough limits. The Directors announced that, as from Dec. 30, 1921, the price of gas under the new system of charge will be 1s. per therm within the borough of Tunbridge Wells and the district of Southborough. This is equivalent to a reduction of 3d. per 1000 c.ft.



"BEARSCOT" TUBING IN WATER CONDENSERS EXTENDS UPWARDS OF 150 MILES.

WATER-COOLED CONDENSERS

AS FITTED WITH THE **"BEARSCOT"** SAFE JOINT TUBE.

With our Central Port Fourway Valve the Condensers may be Reversed or Bye-passed as Required.

PARTICULARS WILL BE SUPPLIED UPON APPLICATION TO—

R. & J. DEMPSTER, LD.

Telegrams: "Scrubber Manchester"

MANCHESTER.

LONDON OFFICE:
34, VICTORIA STREET, WESTMINSTER, S.W.1.

Gas Poisoning Case at Belfast.—John Hayes, aged 70, of Omagh, while on a visit to Belfast, lodged in a room in Athol Street, where he was found in an unconscious condition as a result of gas poisoning. He died in hospital. The belief is that, after turning off the gas on his retirement to bed, Hayes accidentally turned the tap on again.

The Danger of Defective Gas-Taps.—It was revealed at an inquest last week at Pontypool, on Mr. E. L. D. Pitten, auctioneer, who was found dead in his bathroom from gas poisoning, that the tragedy was due to a defective fitting. Answering the Coroner, the Doctor stated that he found one gas-burner in the bathroom fully turned on. The tap was loose, and easily turned. The Coroner, "Was it one of those wretched things that go round and round with nothing to stop them?" The Doctor, "Yes." The Coroner, "They should be abolished. It ought to be a crime to sell them. You think you have turned the gas off, when in reality you have not done so." A verdict of "Accidental death, due to suffocation by gas," was returned.

Manchester Gas-Works Extensions.—The Manchester City Council will consider at their meeting to-day a report from the Gas Committee on proposed extensions at the Bradford Road and Droylsden works which are estimated to cost £477,108. The proposals have already been considered by the Finance Committee; and the Council will be asked to approve them, and to apply to the Ministry of Health for consent to borrow the sum necessary.

Municipal Trading at Batley.—An interesting comparison of municipal trading departments is made in the abstract of accounts for Batley, for the year ended March 31, 1921, just issued. The gas department figures show a loss for 1920-21 of £1689, as against the loss in the previous year of £6438. From 1911 to 1918 there had been profits, and large sums were transferred to relief of the rates; so that it seems the department is recovering after the exceptionally bad time of 1919-20. The electricity department, which had experienced losses for four years, managed to realize a profit of £1944 for 1920-21.

STOCK MARKET REPORT.

IN the Stock Exchange last week the usual course of realizations to secure profits on recent advances set in, and took some of the cream off the top of most markets, including the highest class. The big four got off lightly; Victory only being hit. Friday's figures were: Consols 55½-56¼, War Loan 96-96⅛, Funding 81⅞-82⅜, Victory 84⅛-85⅛. Colonials were firm, and Indians weak. Home Rails were moderately sold. Canadians were firm.

Business in the Gas Market was quite active and very buoyant, and the general rise in prices was at full pressure. In the London Companies, Gas Light ordinary rose 6, South Metropolitan 6, and the two Commercials 10 and 15 respectively. In Suburbans and Provincials, Bournemouths, Brentfords, and Croydons rose freely *ex div.*, Ilford "A" advanced 12½ and ditto "B" 7, South Suburban 3½, South Shields 7, Tottenham "A" 1⅛ and ditto "B" 5. In Continentals, Imperial was in better demand, and the quotation advanced 5 and the debenture 4. European also had a moderate advance. Primitiva was steady and unchanged.

Bargains done for cash during the week were as follows: On Monday, European 8¼, 8⅜, Gas Light ordinary 75⅛, 75⅜, 76, 76¼, 76⅜, 77, ditto maximum 55, 55⅛, 55⅛, 55⅜, 55⅛, 56, 56⅛, ditto 10 p.c. bonds 155, Imperial Continental 136, 136½, 137, Monte Video 57, South Metropolitan 76⅜, 77¼, 77½, 78, 78½, 79, 79½, South Suburban 89, Liverpool 7 p.c. preference £30 paid 33¼ 34½. On Tuesday, Bournemouth "B" 9⅛, Commercial 4 p.c.t. 71, 76, ditto 3½ p.c.t. 70, 72, 73, 74, Croydon "C" 156, European 8 11/16, Gas Light ordinary, 76¾, 77, 77⅛, 78, 78¼, 79, 80, ditto maximum 56⅛, 58, ditto preference 70½, ditto 10 p.c.t. bonds 160, Imperial Continental 136, 136½, 137, 137½, 138, 138⅛, Metropolitan of Melbourne 96, Monte Video 57⅞, Primitiva preference 40s. 3d., South Metropolitan 80, 80⅛, 80¾, 81⅛, Tottenham "B" 78, 79¼, 79½, Liverpool 7 p.c.t. preference 104⅜, ditto £30 paid 34⅛-35. On Wednesday, Bournemouth "B" 9⅛, Brentford "B" 84, Commercial 4 p.c.t. 75, 76, 77, European 8⅛, 8 11/16, 8⅝, Gas Light ordinary 79⅝, 80, 80⅛, 80½, 80⅝, 81, ditto debenture 54⅛, Imperial Continental 139, 139½, Monte Video 57⅛, Primitiva 15s., ditto preference 42s., South Metropolitan 80½, 81½, 83, ditto 6½ p.c.t. debenture 105, South Suburban 90, Tottenham "B" 78, 80½, ditto debenture 70, Liverpool 7 p.c.t. preference 104½-105⅛, ditto £30 paid 34⅛-35½. On Thursday, Bournemouth preference 60, Commercial 4 p.c.t. 79¾, Gas Light ordinary 78, 78⅛, 78⅝, 78½, 80, 80¼, 80⅛, 80¾, ditto maximum 58, 59, 59⅜, Imperial Continental 138⅛, 140, Lea Bridge 80, Monte Video 56⅛, 58, 58⅜, Newcastle 74, 74⅛, Primitiva 15s., ditto preference, 41s. 9d., 42s. 6d., South Metropolitan 81, 81⅛, 82, 83⅛, South Suburban 86, Tottenham debenture 70½, Liverpool 7 p.c.t. preference 104½-105, ditto £30 paid 34⅛-35½. On Friday, Bournemouth 5 p.c.t. 9⅛, Commercial 4 p.c.t. 79, 80, Gas Light ordinary 79, 79¼, 79⅛, 79⅜, 80, 80¼, 80⅛, 80⅜, 81, Imperial Continental 140, 141, ditto debenture 69¼, Liverpool 69⅜, ditto 7 p.c.t. preference £30 paid 34½-35⅛, Monte Video 58⅛, Newcastle debenture 63, Oriental 85⅛, 86, Primitiva 14s., ditto preference 43s., South Metropolitan 81, 83⅛, ditto 6½ p.c.t. debenture 103½-104½, Tottenham "A" 90, 91, ditto "B" 77, 78, 80, 81, Uxbridge 63, 63½, Barnet "C" 106, 106½, ditto "D" 71, 71½.

In the Money Market, extreme variability was the dominant characteristic, firmness and ease alternating from day to day, the latter predominating at the close. Discount tendencies coincided. Silver fell steadily, the last price being 32⅛d. The Bank rate is 4½ p.c., as fixed on Feb. 16.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issues.	Share.	When ex-Dividend.	Ante-War Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices, July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
£			p.s.					
182,049	Stk.	Aug. 26	4	4%	Aldershot 4 p.c. Pref.	...	50—55	...
1,551,868	,,	Oct. 13	9½	3½%	Alliance & Dublin Ord.	59—64	58—61	...
274,000	,,	Jan. 12	4	4%	Do. 4 p.c. Deb.	76—79	46—51	...
280,000	5	Nov. 30	7½	4/-	Bombay, Ltd.	5½—6½	5½—3½	...
100,000	5	Feb. 23	16	7½%	Bournemouth Gas and Water { 5 p.c. B 7 p.c. Pref. 6 p.c. 4 p.c. Deb.	...	9—10*	...
585,110	10	,,	7	7%		15—15½	8½—9*	...
115,000	10	,,	6	6%		13¼—14	7⅜—8*	...
162,085	—	Dec. 30	—	4%		...	65—70	...
992,045	Stk.	Feb. 9	14	56/-	Brentford A Consolid.	261—266	82—87*	...
734,920	,,	,,	11	55/-	Do. B New	204—209	82—87*	84
55,000	,,	,,	5	5%	Do. 5 p.c. Pref.	109—111	70—75	60
221,400	,,	Dec. 15	4	4%	Do. 4 p.c. Deb.	91—93	65—70	...
214,775	,,	Aug. 26	11	10½%	Brighton & Hove Orig.	208—213	132—137	...
244,200	,,	,,	8	7½%	Do. A Ord. Stk.	154—159	92—97	...
1,287,500	Stk.	July 28	5	5%	Bristol 5 p.c. max.	...	...	...
530,000	20	Sept. 29	12½	10%	British	44—45	26—28	...
120,000	Stk.	Dec. 30	4	4%	Do. 4 p.c. Deb. Stk.	88—90	60—65	...
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	85—87	50—55	...
100,000	10	May 27	—	6%	Cape Town & Dis., Ltd.	1⅜—2⅛	6—7	...
100,000	10	Oct. 28	—	4½%	Do. 4½ p.c. Pref.	4—6	4½—5½	...
100,000	Stk.	Dec. 30	4½	4½%	Do. 4½ p.c. Deb. Stk.	70—75	58—61	...
137,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108—110	...	...
1,515,280	,,	July 28	5/9/4	42/8	Commercial 4 p.c. Stk.	106—108	77—82	71—80
560,000	,,	,,	5½	38/4	Do. 3½ p.c. do.	103—105	74—77	70—74
475,000	,,	,,	5	5%	Do. 3 p.c. Deb. Stk.	69½—71½	49—52	...
800,000	,,	Dec. 15	4	—	Continental Union Ltd.	7⅝—7⅞	18—20	...
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115—118	33—38	...
51,600	,,	Feb. 23	15	15%	Croydon A 10 p.c.	...	185—195*	...
278,400	Stk.	,,	12	12%	Croydon B and C 7 p.c.	...	145—155*	156
492,370	Stk.	—	6	4½%	Derby Con. Stk.	123—125	...	...
55,000	,,	—	4	4%	Do. Deb. Stk.	102—104	...	...
1,002,180	10	Jan. 26	10	5/0	European, Ltd.	17½—18	8½—8¾	8½—8¾
16,298,975	Stk.	Feb. 23	4/17/4	46/8	Gas Light and Coke { 4 p.c. Ords. 5½ p.c. max. 4 p.c. Con. Pref. 5 p.c. Con. Deb. 10 p.c. Bonds.	9⅛—10⅜	78—81*	75½—81
2,600,000	,,	,,	5½	55/-		76—79	56—59*	55—59½
4,062,255	,,	,,	4	4%		96—99	68—73*	70½
1,674,850	,,	Dec. 15	5	5%		72¼—74½	53—58	54½
150,000	,,	Dec. 11	10	10%		...	...	155—160
82,500	,,	Sept. 14	5	5½%	Hastings & St. L. 5 p.c.	...	...	...
258,740	,,	,,	5½	2½%	Do. 5½ p.c.	87—89	45—55	...
70,000	10	May 12	11	5%	Hongkong & China, Ltd.	16½—16¾	5⅛—6⅛	...
86,600	Stk.	Aug. 26	9	9½%	Hornsey 7 p.c.	...	100—105	...
131,000	,,	July 28	7½	7½%	Ilford A and C	151—154	110—120	...
65,780	,,	,,	6½	5½%	Do. B	113—118	92—97	...
65,500	,,	Dec. 30	4	4%	Do. 4 p.c. Deb.	92—94	80—85	...
1,976,000	,,	Oct. 28	9	5%	Imperial Continental	150—160	138—143	136—141
1,255,000	,,	Feb. 9	3½	3½%	Do. 3½ p.c. Deb. Red.	84—86	67—72	69½
833,242	,,	Aug. 26	6½	6½%	Lea Bridge Ord. 5 p.c.	119—121	75—80	80
2,498,905	,,	Feb. 26	10	57/6	Liverpool 5 p.c. Ords. A. B.	211—215	...	69½
306,083	,,	June 26	4	4%		146—148	...	...
165,736	,,	Aug. 11	7/5/6	6%	Do. 4 p.c. Pr. Deb. Stk.	...	...	...
63,480	,,	Dec. 30	—	3%	Maidstone 5 p.c.	...	54—56	...
75,000	5	June 11	6	3%	Do. 3 p.c. Deb.	...	43—46	...
250,000	100	Oct. 3	4½	4½%	Malta & Mediterranean	4½—4¾	2—2½	...
541,920	Stk.	Nov. 30	4	4%	Met. of Melbourne 4½ p.c. Deb.	99—101	93—100	96
1,875,892	,,	Feb. 23	4½	4½%	Monte Video, Ltd.	11½—12	55—60	56½—58½
529,705	,,	Dec. 30	3½	3½%	Newcastle & Gateh'dCon.	98½—99½	72—73*	74—74½
15,000	10	Aug. 26	—	7/6	Do. 3½ p.c. Deb.	82—83	62—64	63
33,940	10	,,	7/14/0	5/3	North Middlesex 10 p.c.	...	12½—13	...
300,000	Stk.	Dec. 15	8	8%	,, ,, 7 p.c.	14—15	9—10	...
60,000	5	—	10	—	Oriental, Ltd.	117—122	84—87	85½—86
188,120	Stk.	Dec. 30	—	6%	Ottoman, Ltd.	7½—7¾	2—3	...
60,000	50	Aug. 26	13	60/-	Plym'th & Stonch'se 5 p.c.	...	69—71	...
100,000	50	,,	12	55/-	Portsea Island, B	128—131	74—77	...
249,980	5	—	8	—	Do. C	118—121	51—54	...
499,960	5	—	5	—	Primitiva Ord.	5⅛—6	1—1½	14/—15/-
521,600	100	Dec. 1	4	4%	Do. 5 p.c. Pref.	4⅛—5	1⅛—2½	40/3—43/-
600,000	Stk.	Jan. 26	4	4%	Do. 4 p.c. Deb.	91—93	74—76	...
346,198	,,	Dec. 30	4	4%	Do. ,, ,, 1911	...	50—55	...
150,000	10	Sept. 29	6	6/-	River Plate 4 p.c. Deb.	85—87	50—55	...
125,000	50	Jan. 3	5	5%	San Paulo { 6 p.c. Pref. 5 p.c. Deb.	10½—11	6—6½	...
135,000	Stk.	Aug. 26	10	5%		47—49	36—39	...
209,984	,,	,,	10	5%	Sheffield A	223—224	68—70	...
323,500	,,	,,	10	4½%	Do. B	222—224	68—70	...
133,201	Stk.	Sept. 15	4	4%	Do. C	220—222	68—70	...
90,000	10	Oct. 28	9	8%	Shrewsbury 5 p.c.	...	...	...
2,609,895	Stk.	Feb. 9	5/4/0	5%	South African	10½—11½	7—9	...
250,000	,,	Jan. 12	—	5%	South Met. Ords.	111—113	82—84	76½—83½
1,895,445	,,	,,	5	5%	Do. Red. Pref.	...	94—96	...
224,820	,,	Feb. 23	8½	4½%	Do. 3 p.c. Deb.	72½—74½	51—54	...
1,087,795	,,	,,	6	5½%	South Shields Con. Stk.	157—159	91—93*	...
368,837	,,	Dec. 30	5	5%	S'th Suburb'n Ord. 5 p.c.	114—116	86—91*	86—90
647,740	,,	Nov. 16	5	4%	Do. 5 p.c. Deb. Stk.	116—118	77—80	...
121,275	,,	Dec. 30	4	4%	Southampton Ord.	99—102	57—60	...
120,000	,,	Feb 23	—	6%	Do. 4 p.c. Deb. Stk.	...	60—62	...
782,275	,,	,,	6	4½%	Tottenham { A 5 p.c. B 3½ p.c.	135—138	87—92*	90—91
181,255	,,	Dec. 15	4	4%		115—117	77—82*	78—81
182,380	10	Dec. 30	5	—	District { 4 p.c. Deb.	87—89	62—67	70—70½
149,900	10	July 1	5	5%	Tuscan, Ltd.	5—6	1—2	...
236,476	Stk.	Aug. 26	5	3½%	Do. 5 p.c. Deb. Red.	93—95	45—50	...
					Tynemouth 5 p.c. max.	108½—109	67—69	...
					Wandsworth, Wimbledon, and Epsom—			
30,000	,,	Aug. 11	8½	66/3	Wandsworth A 5 p.c.	151—156	84—86	...
255,636	,,	,,	6½	51/3	Do. B 3½ p.c.	129—134	68—71	...
108,075	,,	,,	—	46/4½	Do. C	...	63—67	...
140,865	,,	,,	—	46/4½	New Ordinary	...	65—67	...
352,000	,,	,,	6½	45/-	Wimbledon 5 p.c.	117—122	63—67	...
98,000	,,	,,	6½	50/-	Epsom 5 p.c.	121—126	63—67	...
88,476	..	Dec. 10	3	3%	3 p.c. Deb. Stk.	66—69	50—55	...

* Ex Div.

A Cheaper Gas at Barnstaple.—A reduction of 6d. per 1000 c.ft. in the price of gas, to date from the next meter reading, was the welcome announcement made at the annual meeting of the Barnstaple Gas Company. Mr. F. W. Hunt (the Chairman), moving the adoption of the report, said the average price of coal had been £2 17s. per ton, compared with £2 6s. 6d. in 1920 and 19s. 10d. in 1914. So since 1914 coal prices had increased 190 p.ct., and the price of gas 105 p.ct. The Directors recorded their appreciation of the untiring and devoted services of the Manager and Secretary (Mr. F. L. Schofield) during the stress of the past seven years.

Fleetwood Gas Company.—The half-yearly report of the Fleetwood Gas Company shows a capital expenditure for the last six months of £460. On the revenue account, there was a profit of £1328, reduced by loan interest to £942. The Directors recommend a dividend of 7½ p.ct. on the preference stock and 3½ p.ct. on the ordinary stock, with a balance of £73 carried to profit and loss account. Regret is expressed at the death of Mr. J. T. Partington, for twenty years a Director and for one year Chairman of the Company. The paid-up capital is £76,388; and the gas sold last year was 73,719,000 c.ft. During the year an improved gas-making plant has been installed to meet the demands.

Romford Gas and Coke Company, Ltd.—In their report for the second half of 1921, the Directors state that the revenue profit carried to profit and loss account is £4284. To this is added the sum of £59 interest on insurance fund, making a gross profit of £4343. This amount, added to the balance brought forward, makes an available total of £9205. After providing for reserve fund, bank interest, depreciation fund, interest on reserve and insurance funds, debenture bonds, consumers' deposits, &c., there remains a net balance of £6145. Dividends of 5¾ p.ct. on the original shares and 4¼ p.ct. on the "B" shares (both less income-tax) for the half year ended Dec. 31, together with 1½ p.ct. (less tax) on both classes of shares in respect of the first half of 1921, to equalize the rates for the whole year, will amount to £3368, leaving £2777 to be carried forward. The sale of gas shows an increase of 7·37 p.ct. over the corresponding period of 1920. The Board of Trade granted an Order under section 1 of the Gas Regulation Act, 1920, which modifies the Company's standard prices and authorizes the charging for gas on a thermal basis.

Storage Capacity at Dunfermline.—A minute of the Gas Committee adopted at the last meeting of the Dunfermline Town Council stated that, in view of unemployment, decreasing prices, and growth in gas output, the Manager (Mr. James Campbell) advised consideration now of the question of gasholder capacity at the works, which had been mentioned in his last two annual reports. He pointed out that, compared with a winter make of over 1,100,000 c.ft., No. 1 gasholder, which is over forty years old, has a capacity of 200,000 c.ft.; and No. 2 holder, built in 1893 and in good order, has a capacity of 300,000 c.ft., which, by addition of a third lift (only possible if the holder were temporarily disused), would be increased by 170,000 c.ft. The Committee were disposed to agree with the Manager that additional storage at the works was necessary, to the extent of providing capacity for approximately twenty-four hours' maximum production, which would serve to counteract any inequalities of production and consumption from day to day, and thus help to regularize working conditions. Meantime, they appointed a Sub-Committee to go further into the question (including type of construction), to visit other works, and to report with their recommendations.

Messrs. G. Hands and Co., of Farringdon Road, E.C., have secured an order from the Ramsgate Corporation Gas Department for 320 street-lamps.

The Directors of the Dundalk Gas Company have declared dividends of 15s. and 10s. 6d. per share on the "A" and "B" issues respectively, being the same as six months and a year ago.

Mr. Samuel Moore, late of Scunthorpe, announces that he has taken up his duties as Managing Director of Moore's Gas Generator Syndicate, Ltd., at No. 1, Upper Woburn Place, London, W.C.

From Messrs. George Glover and Co., Ltd., of the Ranelagh Works, Royal Avenue, Chelsea, we have received a novelty calendar—the intention of which is to advertise the Ranelagh price-changer prepayment meter. It is a real novelty. The background of the calendar is a picture of the meter complete; the dates are in a block where the meter-index is usually located; and the price-changer is a separate movable disc, by which the day of the week is altered.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON TUESDAY, to ensure insertion in the following day's issue.

Orders to Alter or Stop PERMANENT ADVERTISEMENTS should be received by the FIRST POST on Monday.

UNDISPLAYED ADVERTISEMENTS: Situations Wanted, Six Lines and under (about 36 words) 3s.; each additional Line, 6d. Situations Vacant, Apparatus Wanted and for Sale, Contracts, Public Notices, &c., 9d. per Line—minimum, 4s. 6d.

TERMS OF SUBSCRIPTION to the "JOURNAL."

		ONE YEAR.	HALF-YEAR.	QUARTER.
United Kingdom	Advance Rate:	35/-	18/-	10/-
	Credit Rate:	40/-	21/-	11/6
Abroad (in the Postal Union) Payable in Advance		40/-	22/6	12/6

In payment of subscriptions for "JOURNALS" sent abroad, Post Office Orders or Bankers' Drafts on London only are accepted.

All Communications, Remittances, &c., to be addressed to WALTER KING, LIMITED, 11, BOLT COURT, FLEET STREET, LONDON, E.C. 4.

Telegrams: "GASKING, FLEET LONDON." Telephone: Holborn 6857.

OXIDE OF IRON

FOR SALE OUTRIGHT, OR ON LOAN.

SPENT OXIDE

PURCHASED IN ANY DISTRICT.

GAS PURIFICATION & CHEMICAL CO., LTD.,
PALMERSTON HOUSE,
OLD BROAD STREET, LONDON, E.C.2.

"VOLCANIC" FIRE CEMENT.
Resists 4500° Fahr. Best for Gas-Works.
ANDREW STEPHENSON, Gresham House, Old Broad Street, LONDON, E.C. "Volcanism, London."

BRITISH GAS PURIFYING MATERIAL.

ENGLISH BOG ORE AND NATURAL HYDRATED OXIDE OF IRON,
SPENT OXIDE BOUGHT.

BRITISH GAS PURIFYING MATERIALS CO., LTD.
ARCADIAN GARDENS, WOOD GREEN, LONDON, N. 22.
Telegrams: "Bripurimat, Wood, London."
'Phone: Palmers Green 608.

ENQUIRIES SOLICITED.

FOR Gas Works Plant of Every Description; also SULPHATE OF AMMONIA and SULPHUR RECOVERY PLANTS.
C. & W. WALKER, LIMITED,
DONNINGTON, NEWPORT, SALOP.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 45 & 47, Westminster Bridge Road, LONDON, S.E. 1.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
Telegrams—
"BRADDOCK, OLDHAM," and "METRIQUE, LAMB, LONDON."

HIGH-PRESSURE DISTRIBUTION.

COMPLETE Tables for Flow of Gas in Mains, at all Pressures from ⅛ inch to 100 lbs.
Many other useful PRESSURE TABLES.
See "DISTRIBUTION BY STEEL" (Woodall and Parkinson), SECOND EDITION 15s. 9d., Post Free, BENN BROS., LTD., 8, Bouverie Street, LONDON, E.C.4.

SULPHURIC ACID.

SPECIALLY prepared for the manufacture of SULPHATE OF AMMONIA.
SPENSER CHAPMAN & MESSEL, LTD.,
with which is amalgamated WM. PEARCE & SONS, LTD.,
Mark Lane, LONDON, E.C. Works—SILVERTOWN.
Telegrams—"HYDROCHLORIC, FEN, LONDON."
Telephone—1588 AVENUE (3 lines).

BRITISH LUX.
AN EXCELLENT PURIFYING MATERIAL.
Features:—
(a) Porosity equal to Best Bog Ore.
(b) Contains Ferric Hydrate in an active state, thus resembling "Lux."
(c) Prepared in good mechanical condition ready for Purifiers.
Prices and Terms on Application to H. C. FAIRLIE & Co., LTD., FALKIRK.

OXIDE OF IRON.
SPENT OXIDE BOUGHT.

BALE & CHURCH, LTD.
33, ST. MARY AT HILL, LONDON, E.C.3.
Phone: Minories 1484.

"TORTO" FIRE CEMENT.

BALE & CHURCH, LTD.
33, ST. MARY AT HILL, LONDON, E.C.3.
Phone: Minories 1484.

"KLEENOFF," THE COOKER CLEANSER.
Tins for Sale to Consumers.
In Bulk for Works Use.

BALE & CHURCH, LTD.
33, ST. MARY AT HILL, LONDON, E.C.3.
Phone: Minories 1484.

HUTCHINSON BROTHERS, Ltd.
FALCON WORKS, BARNSLEY.

MANUFACTURERS OF
GAS METERS (Ordinary and Slot),

"FALCON" INVERTED LAMPS,
SQUARE STREET LANTERNS
SUPERHEATER BURNERS, and
CONVERSION SETS for Street Lanterns

SPENCER'S Patent Inclined HURDLE GRIDS.

THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, p. 535.

Continued on p. 530.

J. & J. UEMPSTER, LTD., CONNAUGHT MANSIONS, 34, VICTORIA STREET, S.W. 1. MANCHESTER. HEAD, WRIGHTSON, & CO., LD., for PURIFIERS, &C.